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Strategic Use of Expanded Municipal Tax Bases

by

Iryna Nekhayevska

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Abstract

This research is inspired by the financial situation of Canadian municipalities, facing, on the expenditure side, increasing demands, especially for infrastructure upgrading, and, on the revenue side, a combination of slow-growing own property taxes and reduced grants. This dissertation explores municipal tax base diversification, often suggested as the best way of providing cities with reliable financial resources while preserving their operational flexibility, and intergovernmental fiscal competition, a force that may constrain the benefits of tax diversification. Of several potential tax candidates, consideration is restricted to the highly revenue productive sales and payroll taxes, widely used by U.S. municipalities.

Initially, tax base diversification is examined in the case of an isolated municipality in order to establish a benchmark. Next, the strategic setting is introduced through a multi-jurisdictional environment where there is interjurisdictional competition for mobile commercial property investment. The actual benefits from adding new taxes are determined with and without limited residential mobility – that is, residential mobility limited to cross border shopping or commuting. Finally, the derived reaction functions are estimated, using municipal data for Washington State, to identify the existence of strategic tax interactions and the impact of fiscal constraints.

The theoretical analysis confirms that tax base diversification raises the efficiency of public service provision, reduces overtaxation of commercial property and promotes benefit taxation. Although these benefits are observed to decline in the multi-jurisdictional environment, the diversified tax system generally continues to be more efficient. A potential reduction in the benefits depends not only on the degree of capital

mobility and individual preferences, but also on the extent of cross-border shopping and commuting. In the absence of these cross-border interactions, the introduction of a sales tax is preferred to a payroll tax, but, in their presence, the opposite is true. The strength of municipal tax competition is shown to diminish if property tax rates are differentiated to extract rents from commercial property and/or if private good consumption is enhanced through public service provision.

The empirical examination of fiscal interactions among Washington municipalities reveals positive interactions in some taxes and no interactions in others. The presence and type of constraints on municipal tax choice prove to be important determinants of these relationships. The non-existence of strategic responses is the outcome when there are tax rate limits that are closely followed. On the other hand, the introduction of a tougher growth restriction on property tax revenues that did not result in the overwhelming adoption of the maximum allowable limit is found to have no effect on the existing municipal interdependence of property taxes. In contrast, attempts to restrict tax base exporting of municipal business taxes is shown to reduce the evidence of direct positive competition in these taxes.

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Chapter 1. Introduction

1.1. Changing Local Finance in Canada

The Canadian municipalities, and especially Canadian cities, have recently become a focus of political and public policy/finance attention as the growth in their financial capacity is considered to be insufficient to match their increasing economic importance and local requirements. Cities and metropolitan areas have steadily acquired economic power through a concentration of workers, industries and research centres, and have become a source of competitive advantage for their provinces and the entire Canadian economy. In 2001, the six biggest Canadian cities – Toronto, Montreal, Vancouver, Ottawa, Calgary and Edmonton – accounted for 40% of the country's population.[1] The same year, the combined GDP of Toronto and Ottawa represented 54% of Ontario's GDP, Vancouver's GDP was 53% of British Columbia's GDP, Montreal's GDP was 50% of Quebec's GDP, and the combined GDP of Calgary and Edmonton was 63% of Alberta's GDP.[2] Since the early 1990s, the metropolitan areas (and municipal governments, generally) were given additional responsibilities for municipal airports, local ports and harbours by the federal government and for various services by the provinces.[3] More obvious and less controversial than service offloading is the fact that the provinces (arguably excluding Quebec) reduced transfers to their municipalities, with

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[1] http://www.citymayors.com/gratis/canadian_cities.html.
[2] http://www.citymayors.com/politics/canada_hubs.html.
[3] There was considerable variation in the responsibilities downloaded (if any) by each province. Ontario stands out for having offloaded major services, including transit, child care, social housing and assistance, ferries and property assessments. Although its reorganization was accompanied by grants (notably for social assistance), the net effect is generally considered to have imposed extra burdens on municipal taxpayers. Other examples of offloading are part of social services in Manitoba, a portion of educational services in Nova Scotia and a higher share of transportation in Saskatchewan and (temporarily) Alberta.

the decrease amounting (overall) to about 10% of municipal revenues during the 1990s.[4] Unfortunately, both extensive urban concentration and off-loaded responsibilities failed to translate into any significant change in municipal own tax revenue sources which were still limited by the slow growth of property taxes. As a result, reliance on property taxes increased.

The ability of the Canadian cities to continue expanding local public services and infrastructure as well as maintaining existing services is being seriously questioned. A number of studies on their competitiveness show that Canadian cities have fallen seriously behind their US and Western European counterparts.[5] Since U.S. metropolitan cities commonly levy a number of different taxes, they manage to distribute an overall higher tax burden over several tax bases.[6] Such revenue diversification also eases the pressure to heavily tax non-residential property, a practice which has increased business costs in the Canadian cities.[7] In most cases the metropolitan areas of the European Union also enjoy wider access to different taxes.[8]

The expectations of a similar solution in Canada have been preceded by speculation about what new local taxes should appear in the fiscal structure of municipalities. Many heads once again turn to the country's closest neighbour. Historically, Canadian and U.S. local tax systems share the same British heritage in the form of heavy reliance on property taxes. However, the U.S. municipalities moved away from this base due to: 1)

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[4] In some cases the fiscal arrangements included municipal financial reform, such as to increase property tax revenue in Ontario, access casino profits (10%) and provincial traffic fines (determined by a special formula) in Vancouver, and receive a portion of provincial fuel taxes for Montreal (1.5¢ per litre), Calgary and Edmonton (5¢ per litre).

[5] Lapointe (2004), Slack (2003) and Ploeg (2002).

[6] Slack (2003).

[7] Kitchen and Slack (1993), KPMG (1995) and Slack (2003). Slack shows that effective tax rates on non-residential property are generally higher in Canada than the USA.

[8] www.canadascities.ca/fcm_execsummary_e.pdf.

an increased number of tax and expenditure limits on property taxation imposed through referenda or by state legislatures, and 2) as a result, municipalities were granted access to alternative revenue sources such as sales, income and business taxes. The numerous fiscal similarities between Canadian and U.S. cities established by recent comparative studies encourage the thought of modeling new municipal taxes on those used across the border.[9]

1.2. New Taxes for Canadian Cities

There are a number of taxes that can be considered for the role of new local fiscal instruments in Canada. A list of possible candidates to complement property taxes include local personal income taxes, payroll taxes, general sales and business taxes,[10] fuel and motor vehicle taxes, as well as hotel, restaurant and entertainment taxes. Any choice should depend upon their merits in the Canadian municipal situation. Of the criteria for tax suitability evaluation proposed by Weistroffer, Wooldridge and Singh (1999),[11] priority here is given to tax productivity, administrative feasibility, regulatory neutrality (no or few distortions) and acceptability to the provinces.

Application of the productivity criterion[12] eliminates business, hotel, restaurant and entertainment taxes as there are doubts about how successfully these bases can be taxed due to the nature of their activities (potential tax base erosion and tax evasion). The revenue estimates for personal income, sales and fuel taxes calculated by Kitchen and Slack (2003) for a number of Canadian cities reveal that even small local surcharges on

---

[9] Lapointe (2004), Slack (2003) and Ploeg (2002).
[10] Local business taxes in the USA include head taxes per employee or taxes on gross annual receipts.
[11] The full list of criteria, in their order, reads: 1) legality; 2) administrative feasibility; 3) social and political acceptability; 4) productivity or yield; 5) horizontal equity; 6) vertical equity; 7) stability; 8) regulatory neutrality (no or few distortions); 9) compatibility with strategic goals.
[12] Consideration of only the local governments ignores the vertical implications of their taxes reflected in their potentially large marginal costs of funds. With those effects in mind, tax productivity becomes less relevant criterion for judging suitability of local taxes.

existing provincial taxes are extremely revenue productive, by far surpassing, for example, the equivalent hotel taxes. A local sales tax promises the highest potential yield: a 1% municipal sales tax is shown to raise on average 10 times more revenue than a 1% surcharge on provincial personal income taxes and 7 times more then a ¢1 per litre fuel tax.[13] All three of these taxes are extensively and successfully utilized by municipalities in the United States.

The potentially high administrative cost of running a separate tax system for a new tax may prove not worth the revenue collected. If instead the municipalities piggyback on the tax bases of the senior governments, the latter would become responsible for the collection and return of the revenue back to the local jurisdictions at a small additional cost. However, in the case of the fuel tax, piggybacking on provincial collections is not feasible (or, at least, simple) because these taxes are collected at refineries. Consequently, distribution of their proceeds according to a selected formula makes it a revenue sharing arrangement. Some U.S. states share their fuel tax revenues with their cities on a per capita basis. On the other hand, the U.S. municipal experience with personal income and general sales taxes indicates that the piggybacking on state tax bases remains a rather inexpensive administrative option.[14]

Neither the local income tax nor the local sales tax is considered to be regulatory neutral or non-distortionary. According to Goodspeed (1989), municipal reliance on ability to pay as a base for income taxation is likely to cause some misallocation of local

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[13] The much higher productivity of the local sales tax results from the 1% sales tax being levied on the sales tax base, while the 1% local income tax is applied only to provincial personal income taxes paid and not to the income tax base. Thus, the revenues calculated from a "1%" tax are not exactly comparable. However, since provincial income taxes were, at the time, levied as a percentage of federal income taxes, it may have been logical for Kitchen and Slack (2003) to assume that a local income tax would be a percentage of provincial income taxes.

[14] See the discussion in Kitchen and Slack (2003), Kitchen (2002).

resources and some income redistribution among local taxpayers. To reduce, or at least alter, the scope of income redistribution, income taxes can be narrowed to payroll taxes. Commuting patterns tend to provide metropolitan centres with tax exporting opportunities, which some believe to be consistent with benefit taxation.[15] Local sales taxes are consumption based and, thus, may be less distorting as their misallocating impact is not accompanied by a redistributive impact. But, sales taxes offer the possibility of tax burden exportation through cross-border shopping, although generally not justifiable on the grounds of benefits received by out-of-jurisdiction shoppers. Also, retail sales are concentrated in urban municipalities so sales taxes do little for rural municipalities. In the absence of any comparable studies of these taxes under their respective horizontal externalities, accurate assessment of their relative economic distortions is unavailable.

Acceptability to the provinces of local income or sales taxes may be affected by the extent of vertical tax externalities imposed on provincial governments – the greater the potential reduction in provincial revenues under the combined federal, provincial and local tax rates, the less willing the provinces would be to share their tax bases with the municipalities.[16] Consistent with this logic, the wider access of U.S. cities to sales taxes may be stimulated by the smaller overall state revenue distortion due to the absence of a sales tax at the federal level.[17] Since the sales and income tax bases in Canada are co-occupied by the federal and provincial governments, the provincial revenue losses are

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[15] See Kitchen (2003).
[16] Minimization of vertical tax externalities on the provinces is expected to be voter welfare-enhancing.
[17] See Sjoquist, Wallace and Edwards (2002).

expected to be exacerbated by the introduction of local taxes.[18] However, the magnitude of the losses attributable to municipal taxation is likely to be modest relative to the existing impact of federal government taxes on the provinces.[19] With no comparable numerical estimates of the vertical externalities from federal tax policies, it is not clear which tax would be more acceptable to the provinces.[20]

Regardless of the possible productivity advantage of the sales tax, both sales and income taxes continue to be treated as possible contenders for alternative local revenue sources in line with the views expressed by many Canadian authors.[21] Before either tax can be conclusively recommended for the Canadian municipalities, more specific questions about the potential consequences of municipal tax base diversification need to be answered. How would the municipalities respond to tax base expansion? How would they use their new tax bases? How might those choices be influenced by the presence of neighbouring municipalities? Might opportunities for strategic behaviour detract from the fiscal advantages of broader local tax bases? These issues have been explored in the literature.

1.3. Tax Choice and Fiscal Competition Literature

There is an extensive tax choice and fiscal competition related literature that can provide theoretical and empirical background for this research.

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[18] Dahlby and Wilson (2003) demonstrate that under certain conditions, such as an ad valorem wage tax and inelastic demand for labour, vertical fiscal externalities may be positive.

[19] Both federal taxes have recently changed. The federal income tax brackets were expanded and the rate on the lowest bracket was reduced by 0.25% in 2008 and the GST was reduced by 2% in 2005-2008.

[20] Numerical estimates exist only for Canadian personal income taxes. Esteller-Moré and Solé-Ollé (2002) find that during 1982-1996 for every 1% increase in the federal income tax there was a corresponding 0.2% increase in provincial income taxes. Dahlby (1994) measures the distortionary effects of income taxation by calculating its federal and provincial marginal social costs of funds.

[21] Kitchen and Slack (2003), McMillan (2004), Slack (2003), Ploeg (2002) and McMillan (1997) provide general discussions of pros and cons which are not enough to definitely choose one tax over the other.

1.3.1. Theoretical Literature

A change in the perception of interjurisdictional competition is first evident in the literature review conducted by ACIR (1991).[22] After a comprehensive evaluation of the related theoretical and empirical models of the 1980s and early 1990s and their major findings, this study expresses serious doubts about the harmful nature of fiscal competition. A later review by Kenyon (1997) mainly separates the notion of yardstick competition and further emphasizes the positive side of local interdependence. Subsequently, Wilson (1999) credits departures from standard tax competition models, such as imperfectly-competitive market structures, government commitment problems and political economy considerations, for giving rise to efficiency enhancing fiscal interactions. He also distinguishes between "industrial capital" (capital used in production), appropriate for modeling all levels of tax competition, and "residential capital", appropriate mostly for local tax competition, but chooses to restrict his summary to the former.

The majority of the recent literature adopts one of three dominant approaches: standard utility maximization of a representative voter, spatial analysis or game theory. The purpose of the studies relying on the first two techniques is invariably efficiency of public service provision or local government spending. In the utility maximizing approach, local competition often enters the models through combinations of the equalization of returns resulting from mobile inputs[23] or individual utility equalization[24] with the scarcity of economic resources (i.e. limited total endowments of labour and capital in the region). The spatial approach complements the standard utility

[22] U.S. Advisory Commission on Intergovernmental Relations.
[23] Kächelein (2003), Fernández (2001), Hoyt (1999).
[24] Petchey and Shapiro (2000).

maximization approach with the elements of spatial distribution (jurisdiction size, proximity, commuting distances, etc.) to introduce differential competitive tax effects.[25] The main perspective for the game theory approach is yardstick competition.[26] The residents of one municipality compare their taxes and services to those in other jurisdictions to find out whether their politicians are pursuing satisfactory fiscal policies. If they do, they are re-elected, if they do not, they are voted out. Such settings imply finite and repeated games with the game periods being terms in office.[27]

The implications of the interjurisdictional competition and competitive strategies that fall out of the models depend on the assumptions made. It is not uncommon for the theoretical studies to model both the consumption and production sides.[28] Although labour mobility is assumed occasionally,[29] it is capital mobility that dominates the predictions of downward pressure on the municipal taxes.[30] The expectations of stronger competition whenever capital mobility is present may result from the failure of the model to capture important local specifics. First, the capital they tend to work with is usually "industrial capital" which is not always fiscally meaningful to local governments due to uneven spatial distribution of manufacturing facilities and limits in municipal taxing authority over them.[31] Only Zodrow and Mieszkowski (1986) and Brueckner and Saavedra (2001), while retaining standard production functions in their settings, redefine their capital as "residential capital". Second, commonly observed rent extraction from the business sectors through a separate and higher non-residential property tax rate is not

[25] Braid (2000) and (2002).
[26] Besley and Case (1995).
[27] Bordignon, Cerniglia and Revelli (2003).
[28] Production side is needed for conclusions about the efficiency of the municipal public good provision.
[29] Petchey and Shapiro (2000), Fernández (2001).
[30] Zodrow and Mieszkowski (1986), Parry (2003), Brueckner and Saavedra (2001).
[31] Petchey and Shapiro (2000), Fernández (2001), Parry (2003), Fuest and Huber (2001) etc. Advantages and disadvantages of capital tax competition are reviewed by Wilson and Wildasin (2004).

included in the competition models.[32] Third, while exporting part of the tax burden to non-residents through the ownership structure of firms[33] is frequently considered, it is never explicitly linked to tax competition.

Relatively few recent theoretical studies choose to model multiple local taxes[34] and even fewer incorporate limited residential mobility, such as cross-border shopping and commuting.[35] The dominant approach is the simultaneous consideration of various taxes in order to determine which will be chosen in equilibrium and the conditions under which they will be chosen. One of the tax instruments made available to local jurisdictions is often a lump-sum or head tax. If lump-sum taxation is possible, the municipalities are found to avoid taxation of the most mobile tax bases and, thus, reduce pressure on those tax rates. Under certain assumptions – foreign property ownership in Braid (2005), labour mobility in Wilson (1995) and a majority of capital-poor residents in Borck (2003) – a head tax may not necessarily remain the preferred option. Braid (2000, 2002) uses distances between the central city and the suburbs to introduce commuting. However, the complexity of his models makes it harder to account for a larger number of local taxes. There are no known attempts to analyze cross-border shopping under multiple local taxation[36] and, thus, there is no comprehensive comparison of municipal sales, income or payroll taxes in competitive settings.

1.3.2. Empirical Literature

An extensive overview of the existing empirical literature is provided by Brueckner (2003). He divides all studies into "spillover" and "resource-flow" models, with the

---

[32] Rauscher (1998) and Noiset (2003) depart from the voter utility maximization to include rent extraction.
[33] Kächelein (2003) and Braid (2005).
[34] Braid (2000), (2002) and (2005), Borck (2003), Wilson (1995), Pogodzinski and Sjoquist (1993).
[35] Commuting is incorporated by Braid (2000) and (2002).
[36] Cross-border shopping is incorporated under a single sales tax by Ohsawa (1999) and Nielsen (2001).

former generally known as yardstick competition and the latter as tax competition. He also notes that the difference between the two can only be observed in their theoretical frameworks, as both produce indistinguishable empirical specifications for tax and expenditure equations. Most of the empirical studies confirm the presence of government interdependence,[37] although, as a result of specificational similarities, not all of them choose to identify its type.[38] Instead the term "tax mimicking" is used to indicate the presence of positive strategic relationships without specifying their actual cause.

The empirical studies can be alternatively separated by the subject of the research. The majority of the studies are concerned with establishing the presence or absence of municipal fiscal interactions.[39] Only a few are interested in assessing the impact of other factors on these interactions, such as fiscal constraints,[40] degrees of (or variation in) firm mobility,[41] membership in the European Union,[42] etc. It is not uncommon to work with only one tax or public expenditure type at a time, leaving out the rest of the fiscal variables, no matter how potentially important. This approach is consistent with estimating the reduced-form solutions to the first order conditions of the standard utility maximizing theoretical models.

A small number of empirical studies examine more than one fiscal variable. Brett and Pinkse (2000) show that the partly solved first order conditions for the residential property tax allow them to retain more variables in the regression equations. Heyndels and Vuchelen (1998) and Parys and Verbeke (2007) also incorporate more tax effects in

---

[37] Parys and Verbeke (2007), Luna (2004), Buettner (2001), Feld and Kirchgässner (2001).
[38] Ladd (1992), Heyndels and Vuchelen (1998), Revelli (2001) and (2002).
[39] Parys and Verbeke (2007), Luna (2004), Buettner (2001), Ladd (1992), Heyndels and Vuchelen (1998), Revelli (2001) and (2002).
[40] Brueckner and Saavedra (2001).
[41] Carlsen, Langset and Rattsø (2005).
[42] Redoano (2007).

their estimating equations, but do so in two different ways. While considering the simultaneous determination of property and income taxes by Belgian cities, Heyndels and Vuchelen concentrate on the impact of the own taxes on each, while Parys and Verbeke focus on the impact of different neighbours' taxes on the choice of each tax. Both effects prove significant. In line with these approaches, Buettner (2001) introduces lagged expenditure (welfare and debt service) and revenue (income tax, land tax and business tax) variables into his tax regression.

Those authors researching local tax interdependence gravitate towards the use of tax rates as their dependent and explanatory variables. The choice of tax variable varies from the actual percentage rates[43] or mill rates[44] as well as effective tax rates[45] (the revenue collected from a given source over its own tax base). However, two of the reviewed studies deviate from this strategy. Ladd (1992) and Parys and Verbeke (2007) employ "tax burden" (revenue from a given source divided by aggregated personal income) and "revenue per resident of one percent tax" (revenue from a given source divided by its tax rate and then by the number of residents), respectively, to capture differences in municipal tax bases. The dominance of rates in the empirical analysis has an important implication, it makes the handling of local user fees more difficult. To our knowledge, Carlsen, Langset and Rattsø (2005) is the only study dealing with the user fees in a strategic environment. To examine the effect of firm mobility on local user fee competition, they select the business sewerage fees which they measure as "the average

[43] Luna (2004), Heyndels and Vuchelen (1998).
[44] Brett and Pinkse (2000), Revelli (2001) and (2002).
[45] Brueckner and Saavedra (2001).

annual user fees paid for a standardized house".[46] Their results indicate the strong possibility of strategic interactions in this steadily growing source of municipal revenue.

Finally, in his review of the empirical literature, Brueckner (2003) points out the importance of the choice of estimation technique. The spatial interdependence of the local jurisdictions implies the likely presence of endogeneity of some regressors, spatial error dependence and correlation between some explanatory variables and the error term. He argues that these issues may be addressed through instrumental variable (2SLS or 3SLS) or maximum likelihood estimation methods. The majority of empirical studies adopt the instrumental variable (IV) approach, in particular two stage least squares, since they consider one type of tax or expenditure and employ cross section data.[47] Only a few recent works give preference to generalized method of moments (GMM) estimation technique.[48] Examples of GMM and IV using spatial econometrics to examine competitive interaction can be found in Revelli (2001, 2002).

1.4. Present Research

To see how tax base expansion fits into the context of local tax and spending decisions, this study initially considers a single jurisdiction. The same model is then extended to determine how newly added taxes perform under municipal tax competition. Finally, the model is used to derive the reaction functions for an empirical application using U.S. data from the State of Washington. Generally, the topic remains of much broader interest than just predicting the impact of local tax base diversification. With this

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[46] The fees paid by firms are included and their payments are related to the standardized house unit based on their water consumption. Detail discussion is available in Borge (2000).
[47] Only Heyndels and Vuchelen (1998) use three stage least squares.
[48] Parys and Verbeke (2007), Redoano (2007) and Revelli (2001).

research, the author intends to contribute to a better understanding of an existing variety of municipal tax combinations, their efficient implementation and use by the cities.

1.4.1. Theoretical Contributions

The theoretical analysis of local tax choices in an isolated municipality is a topic overlooked by researchers in favour of decision making in competitive conditions, making this literature virtually non-existent.[49] This is unfortunate as an initial consideration in isolation offers a number of advantages. First, the setting of the isolated jurisdiction can be used to better understand the underlying model before examining interjurisdictional competition. Second, the isolated setting can easily be extended to discuss alternative more complex aspects of municipal taxation. The present study chooses to add the possibilities of new municipal taxes and heterogeneous taxpayers to the model. Third, the results of the municipal model in isolation determine, what one may call, "potential benefits" from a tax base expansion versus the "actual benefits" under competitive conditions. As the introduction of municipal competition often implies lower efficiency in the provision of public services, the likely disappearance or at least reduction in the potential benefits of diversification is expected.

In the competitive environment, utility maximization relies on capital movements (or resource flows) and cross-border shopping or commuting to generate fiscal interactions with neighbouring municipalities. The initial theoretical model for one isolated city is extended by introducing a degree of resource mobility and the tax treatment of mobile resources in the following ways. People are assumed to have previously sorted themselves into the local communities according to their preferences so, as residents, they

[49] Pasha and Aisha Ghaus (1995) is the only known study, examining a single city, but they study the impact of property and sales taxes on city size.

are assumed to be immobile. However, they retain a limited degree of mobility as cross-border shoppers and commuters. Nor is all capital perfectly mobile. All property investment is taxed by local governments.[50] Households do not move, so residential property investment is immobile. Furthermore, we admit the possibility of industrial property which is also assumed to be fixed in location. Industrial property may be taxed to extract (some) rents for the benefit of local voters. For the most part, however, industrial property is overlooked. It is commercial or retail property investment (capital) that is assumed to be mobile, consistent with empirical observations. We commonly refer to this type of capital as non-residential property. Our tax treatment of commercial property investment also differs from that in the majority of tax competition studies. First, it is assumed that residential and non-residential (commercial) property may be taxed at separate rates and, second, that rents may exist and may be extracted from non-residential property (with the municipalities maximizing their commercial property tax revenue collections). Both assumptions are in agreement with the observed municipal situation in Canada, where most cities impose a greater effective tax burden on non-residential property than on residential property, often by the use of differentiated property tax rates.

In this property tax context, we introduce additional local methods of taxation – the local sales tax and the local payroll tax. Unlike most tax choice studies, these taxes are modeled with the existing differentiated property taxes, initially without consumer or worker mobility and later with mobility. With the addition of each new tax, the expanded local tax system is compared to the case of a property tax only in order to establish the

[50] Property investment is assumed to consist of land and housing structure (capital) and, thus, a local government is assumed to tax property at its total value. Although the amount of land may be considered fixed within a city, its value is not. More housing capital is expected to cause land value to go up.

implications of the expanded tax base. Further, the sales and payroll tax options are compared with each other to assess their relative merits.

Initially, the cross-border shopping and commuting effects are examined separately for two types of local jurisdictions: winners, those experiencing an inflow of shoppers or commuters, and losers, those experiencing an outflow of own shoppers or commuters. Such winner-loser consideration not only illustrates the full effect of tax exporting practices, but also captures the strategic details behind the responses of the municipalities on both sides of this classification. It also proves capable of explaining avoidance of new taxes by some or their rate clustering around a specific value – tax patterns previously studied only in political economy[51] or yardstick competition settings.

1.4.2. Empirical Contributions

Our model is tested using data from the State of Washington in the United States. The use of the recent U.S. data imposes certain limits on the empirical application. As many U.S. states diversified their municipal tax bases decades ago, the direct effect of the introduction of alternative revenue sources cannot be examined, so we are left to focus on the nature of municipal fiscal interactions. On the other hand, the impact on local strategic behaviour of on-going changes in municipal fiscal restrictions and regulations can be determined and analyzed to understand the implications of adopting such regulations to accompany new municipal taxes in Canada.

Following Heyndels and Vuchelen (1998) and Parys and Verbeke (2007), the empirical research explores more complex local interdependence than is normal in the literature as a number of municipal taxes are incorporated in the analysis. Neither of the two fore-mentioned studies provides a theoretical foundation for their estimating

[51] The government chooses to maximize the probability of its voter support. See Hettich and Winer (1988).

equations. Our use of an empirical specification (response function) derived from partially solved first order conditions is an improvement. The outcome of this exercise results in two major differences from the existing empirical literature. First, all own and neighbours' taxes are included in each tax regression, effectively combining the approaches of Heyndels and Vuchelen (1998) and Parys and Verbeke (2007). And, second, the current expenditure levels are also present in each regression, as opposed to their complete absence in most related works. (Buettner (2001), however, introduced their lagged values). Furthermore, these current expenditures are divided into regular purpose services, provided by cities of all sizes, and special purpose services, provided independently by big cities and jointly with special purpose districts by small cities. The latter arrangement implies surrendering a part of municipal property taxing powers to special purpose districts and explains, in part, differences in city taxes.

The addition of municipal user fees to the empirical analysis is another contribution of the present research. Increased restrictions on taxes in the U.S. (particularly, on property taxes) and related regulations are often accompanied by increases in the types and magnitudes of user fees. Bearing in mind their growing strategic importance for local finances, one of the four "tax" equations is entirely devoted to user fees. Potential differences in municipal user fee bases (as well as in some tax bases) necessitate a search for alternative measures of "taxes". The preference here is given to the "tax level", or tax revenue per capita, which, unlike the "tax burden" and "revenue per resident of one percent tax", seems to offer a more straightforward economic interpretation of taxation in that it denotes a sacrifice in potential consumption made by each local resident in exchange for publicly provided services.

Endogeneity of a number of the fiscal variables in this study dictates the choice of the instrumental variables estimation approach. After some preliminary consideration, the 2SLS estimation method is favored over 3SLS, due to the particularities of local taxes in Washington State. The unwillingness or, perhaps, inability of most municipalities to exercise their choice of business taxation leads to the possible underutilization of business taxes. Consequently, the use of the single-equation 2SLS method ensures that any misspecification of the business tax equations is not transmitted to the estimates of the other equations. There is an additional advantage attached to the 2SLS estimation – the limited use of business taxes can be further investigated, independently of the other empirical results. In particular, it is possible to analyze the probabilities of business tax adoption and to test for sample selection bias.

1.4.3. Results

Without restricting individual preferences in the theoretical model, there is uncertainty with respect to the qualitative strategic theoretical outcomes (but it also does not predetermine certain outcomes). Interjurisdictional competition may be non-existent or there may be either rate increasing or rate decreasing tax competition. Despite the ambiguity of many of the model's predictions, a number of the definite conclusions can be made. First, the tax base expansion in isolation is always preferred as it is found to reduce tax distortion in the local economy, to increase public provision and to reduce the need for discrimination against non-residential property. Second, tax base expansion in the competitive conditions becomes more controversial, but in most cases it is still preferred to the property-only tax system. Third, tax diversification with the sales tax is favoured over that with the payroll tax if cross-border shopping and commuting are

absent. In contrast, the diversification with the payroll tax is favoured over that with the sales tax, if cross-border shopping and commuting are present.

The empirical analysis of existing tax interdependence as well as of fiscal restrictions in Washington adds the following insights. First, the empirical findings confirm positive interjurisdictional interactions in some taxes, but the absence of interactions in others. Second, there are numerous interaction effects between own taxes and very few between own and neighbours' other taxes,[52] with some of these relationships being asymmetric. Third, strategic effects of tax rate and revenue growth limits are found to depend on how closely these limits constrain or are followed by the majority of municipal governments. Fourth, tax base regulations aimed at eliminating tax exporting are found to affect strategic behaviour by making tax competition more difficult.

[52] This type of interdependence includes relationships between own and neighbours' taxes in different (non-matching) tax types (e.g., an effect of neighbours' sales taxes on own property tax).

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Chapter 2. Tax Choices of an Isolated Municipal Government

2.1. Introduction

The choice of tax base is rarely addressed in the local public finance literature. Instead, most of the literature examines tax choice in terms of the level of a single (dominant) tax and usually in inter-municipal competitive circumstances. A municipality's choices among several taxes (bases and levels), to be undertaken in a multi-jurisdictional environment, is the eventual goal of this dissertation. However, the widespread absence of analysis of tax choice prompts investigation to more firmly establish a theoretical foundation. In this chapter, we pursue creative modelling of an isolated municipality's tax choice incorporating political and economic factors including benefit taxation.

The importance of political motivation for tax base expansion is illustrated by reviewing articles with political cost models. A theoretical study by Hettich and Winer (1988) analyzes a government that cares only about its expected support by local voters. They conclude that, even under the simple case of multiple taxes and the provision of one pure public good, the local tax structure is jointly determined by administrative costs and the nature of individual political and economic responses to taxation. Gill and Haurin (2001) choose a specific form for this response in their empirical paper: taxes must be approved by local voters. They claim that, due to increasing economies of scale in the political opposition to an increase in any existing tax, the diversification of the local tax base is politically beneficial. An emphasis on political factors by both studies suggests that, with economic priorities in mind, political concerns should be modeled implicitly – through welfare or representative agent utility maximization.

In this chapter we employ a simple model with housing, a compound private good, and public services provided by a utility maximizing local government. This relatively simple model still leaves a number of assumptions and alternatives to be addressed:

1) economic efficiency versus utility maximization;
2) public services with pure public versus private good characteristics;
3) fixed versus variable housing;
4) only residential property versus residential and non-residential property;
5) homogeneous versus non-homogeneous individuals.

First, the distinction between economic optimality and utility maximization would depend a great deal on the structure of the model (especially, characteristics of the local population, the presence or absence of business property, etc.). With a single tax, fixed housing and identical residents, they are expected to coincide. With changes in the model, the results diverge. The social welfare maximization approach remains a standard reference point, while the maximization of the utility of the representative agent involves the agent's self interest causing departure from the social optimum or socially efficient outcome.[53] A pure utility maximization approach to study tax choices of an isolated municipality is preferred for a couple of reasons. It is consistent with the empirical evidence of local government behaviour being determined by its voters' preferences instead of pure economic efficiency (thus, explaining commonly observed tax shifting practices). A political factor in such a utility maximizing framework remains implicit as long as keeping the voters happy is assumed to increase the re-election chances of local

[53] Pure economic efficiency requires maximization of the overall social welfare whereas voter utility maximization refers only to a single group of agents whose utility is maximized by the government. This conceptual difference between the outcomes is also captured through the variation in the definition of the marginal cost of the public output – its marginal social cost versus its perceived marginal cost.

officials. The only theoretical study done for a closed local area (city) is that by Pasha and Aisha Ghaus (1995). They examine the effects of changes in local property and sales taxes on city size using a model incorporating standard utility maximization and the spatial distribution of a fixed population. Utility maximization allows them to consider the problem in general terms and to derive comparative statistics by applying the envelope theorem. With a spatially distributed population they must impose specific functional forms, making their results sensitive to the elasticity of substitution between housing and non-housing consumption of local residents. As with many others, the interest here is not in the spatial implications as these introduce a variety of (for our purposes) unnecessary complications. Thus, the pure utility maximization technique only is employed as it allows incorporation of political considerations without the complications of spatial distributions.

The study by Brueckner and Saavedra (2001) of capital taxation under competitive conditions avoids political issues by focusing on efficiency of public good provision. Although efficiency does not have to be of a primary concern to an election-minded local government, it is occasionally resorted to here to provide another benchmark against which to alternatively measure government performance.

The second issue is the nature of local public services. Are they a pure public good or do they exhibit private good characteristics? Both possibilities are illustrated in Wilson (1995). Although his conclusions may not be relevant to the analysis in this chapter, due to assumed labour and capital mobility and the specification of the public output type (pure public good or publicly provided private good) based on scale economies in its production rather than its provision, they indicate the sensitivity of the

tax choice outcome to these cases. An underlying assumption of our model incorporating a publicly provided private good (the case in which the per capita amount of public services is consumed individually) is prompted by the empirical evidence. Bergstrom and Goodman (1973) argued that, at a certain population size, the gains from sharing the cost of public services might be approximately balanced by the disutility (due to congestion) from their sharing among more residents. Using the U.S. data for different states, they detected the presence of private good characteristics (non-publicness) in municipal expenditures, particularly on police and general/aggregated services.[54] Although the findings of Bergstrom and Goodman (1973), and later McMillan, Wilson and Arthur (1981), were only true for medium and large size municipal units, the subsequent estimation by Edwards (1986) extended the above features to similar services provided by small jurisdictions.[55] The studies of McGreer and McMillan (1993) and Means and Mehay (1995) also regard the publicly provided private good specification superior for their estimates performed on Australian and Californian municipal data, respectively.

The third issue involves the question of fixed versus variable land/housing consumption.[56] A number of studies in local public finance (including Brueckner and Saavedra (2001)) choose to fix individual land/housing endowments. Alternatively, Wilson's research into property tax, although done for tax competition, points out distinct possibilities (Wilson (1997)). First, given supply and demand functions for housing, there is room for its adjustment to the property tax rate. Second, a publicly provided

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[54] Borcherding and Deacon (1972) obtained similar empirical results but gave them a bit different interpretation.
[55] Edwards (1986) used data for the municipalities in the New York state with less than 10,000 people.
[56] Land and housing (or capital structure) are often combined into one variable. Its consumption is considered either in per capita or per household terms.

good may enter housing demand along with taxes, prices and income. If so, it becomes another change-inducing source in housing demand, exerting a direct influence on consumer choices. These issues are shown to make qualitative differences in utility maximizing outcomes associated with the advantages of tax diversification and benefit taxation (see the discussion related to issue number six below).

The fourth and fifth issues of property tax base differentiation and heterogeneous individuals are the focus of Ladd's empirical study (Ladd, 1975). In her paper, the property tax base is divided into residential and non-residential (commercial and industrial) with high demand and no demand for local education services, respectively. The analysis determines how the contributions of both types of properties affect the willingness to pay for education by local residents. A similar situation in which businesses owned by a minority group of residents pay higher property taxes to subsidize residential services is modeled here.

Differences in preferences and/or incomes bring in more challenges for the local government in determining community demand for public services. To deal with population heterogeneity, Ladd adopts majority rule (through the median voter) "to transform residents' conflicting demands into a single community function". Although the median voter rule remains a good empirical tool,[57] it creates difficulties in our theoretical structure. One possible way to avoid its modeling complications is to assume the sorting of individuals beforehand.[58]

The analysis in this chapter starts with the simple case of fixed housing consumption, no business capital, one local (property) tax and unspecified benefits from public

[57] Turnbull and Mitias (1995).
[58] An underlying assumption in Brueckner and Saavedra (2001).

provision. As these assumptions are modified to reflect the possibilities discussed above, the changes in the perceived marginal cost of funds to finance local public services and residents' marginal willingness to pay are noted and studied. The new equilibrium public good provision is compared with its equivalent pre-change level. The same analysis is also applied to the introduction of new taxes into the local economy. If the post-tax-diversification adjustments in equilibrium public good provision are associated with higher government output provision at the same or lower marginal cost (as perceived by the local voters), then a multi-tax system is preferred over a single tax system.

The key results of this chapter on the municipal tax choices of an isolated municipality are the following: 1) once housing consumption is allowed to change in response to adjustments in the tax rate on housing, tax diversification becomes an attractive (wellbeing enhancing) option under distortionary taxation; 2) additional tax revenue sources (such as a sales tax) allow a municipal government to perform better without discriminating against tax bases (e.g., overtaxation of business property).

2.2. One Tax and One Publicly Provided Good

The major purpose of this section is to provide theoretical insight into the case of an isolated municipality using a single tax (the property tax) to finance the provision of a publicly provided good. This case can then be utilized for comparisons against a two (or even multiple) tax system in the sections to follow. We begin by assuming fixed housing and no business capital, and gradually relax each of these assumptions to consider their implications for local government choice of the property tax and publicly provided output.

2.2.1. Property Tax, Fixed Housing Consumption and No Business Capital

Consider an isolated municipality with **N** local residents whose identical preferences are given by a continuous and differentiable utility function **U**. The residents consume housing **h** (as home owners) and a composite private good **x**. A single publicly provided good **G** exhibits certain private good characteristics and enters individual utility only as its per capita consumption $\mathbf{g} = \frac{G}{N}$. The choice of per capita public output is motivated by applied considerations. First, pure public good characteristics of a single municipal facility (e.g. school) are thought to be limited in geographic space to a community around it and are expected to be disguised by aggregation. A single publicly provided good here is assumed to include several services like schooling and road network. Second, with an increase in the number of people, most municipal facilities need to be replicated to maintain a certain level of quality and fair access by all residents. Modeling per capita public output implicitly implies that once g is decided upon, any population growth has to be accompanied by greater total municipal expenditure G.

The individual utility function, expressed in terms of the locally consumed goods, has the form U = **U(h, x, g)** and is assumed to be strictly quasi-concave and separable in g. Although the separability assumption is commonly used in the theoretical tax literature to simplify model setups, it may ignore the potentially important influence of g on the individual choices of h and x induced by the direct benefits from the publicly provided services as they are related to each good. Residents' wage income **w** is exogenous and

the same for all individuals, implying that identical amounts of h and x are chosen for consumption by all individuals.[59]

Each individual will maximize his/her utility subject to the following budget constraint $w = (1+p)h + x$, where **p** is the property tax rate on housing consumption. The set up is not inconsistent with the reality of local governments in many industrialised countries, particularly those of British heritage. In many of these countries, property taxation is reserved for local government and often constitutes a significant source of municipal own revenue: for example, around 39.3% of total revenue in Canada, 40.4% in the United States, 44.7% in Australia and a much larger share of municipal tax revenue with those percentages being 84.5% in Canada, 74.4% in the United States and 100% in Australia (McMillan, 1997). Because both prices are normalized to 1, the individual choice variables h and x are measured in monetary terms (rather than units). In the local housing market, no distinction is made between land and property capital and h is treated as a combination of land and capital values. In isolation, the potential for housing value changes can be considered limited and, if the alternative use of the available land (e.g. agriculture) and bidding for additional space are ignored, the amount allocated to housing consumption by individuals, $\bar{h}$, is fixed. Under similar preferences and identical wage incomes, this housing asset cannot be sold within the jurisdiction, nullifying any potential capitalization of the property tax into the housing value. Although with a fixed amount of land in the area and a fixed population, $\bar{h}$ looks similar to the land/housing endowment in Brueckner and Saavedra (2001), the presence of invested capital in housing distinguishes it from their housing equivalent of a per capita land endowment

[59] Full employment is assumed.

and permits the change in its treatment from a return-generating input to a consumption good paid from the individual budget. As a result, the consumption of the private good is determined by the individual budget constraint $x = w - (1+p)\bar{h}$ and becomes a function of p, $x^* = x(p)$ (w being exogenous to the municipality itself is suppressed for notational simplicity).[60] This expression for x can be substituted into the utility function to derive the indirect utility of each local resident $U(\bar{h}, x^*, g) = V(\bar{h}, p, g)$.

The publicly provided good is financed only through a property tax on housing. If the production of the publicly provided good is linear with a constant marginal cost of 1 then, in per capita terms, $g = p\bar{h}$ may be provided by the municipality. The benevolent local government will maximize the indirect utility of a representative individual with respect to the quantity of the publicly provided good and tax rate on housing subject to maintaining a balanced budget.

$$L = V(\bar{h}, p, g) + \mu[p\bar{h} - g]$$

$$\frac{\partial L}{\partial p} = V_p + \mu\bar{h} = 0 \quad \text{or} \quad -V_p = \mu\bar{h} \qquad (1)$$

$$\frac{\partial L}{\partial g} = V_g - \mu = 0 \quad \text{or} \quad V_g = \mu \qquad (2)$$

$$\frac{\partial L}{\partial \mu} = p\bar{h} - g = 0.$$

Using the envelope theorem to establish $V_p = -\lambda\bar{h}$ (with λ being the marginal utility of wage income), equation (1) becomes $\lambda\bar{h} = \mu\bar{h}$ or $\frac{\mu}{\lambda} = MSC_g = 1$, where the ratio of the Lagrange multipliers is defined as the marginal social cost of public provision – its

[60] The property tax is treated here as an excise tax rather than an ad valorem tax on assessed property value.

marginal cost (MC_g) adjusted by the marginal cost of the tax funds (MCF) raised by the municipality.[61] Its constant value of 1 results from the facts that the tax revenue collected from the residents is transformed on one-to-one basis into the public output ($MC_g = 1$) and that the only taxed good is fixed and, thus, no tax distortion is induced in the local economy by its taxation ($MCF = 1$). In turn, dividing equation (2) by λ yields $\frac{V_g}{\lambda} = \frac{\mu}{\lambda}$. Since $\lambda = V_w$ is the marginal utility of income, $\frac{V_g}{\lambda} = \frac{V_g}{V_w} = MWTP$ denotes each individual's marginal willingness to pay for the ideal/preferred quantity of the public service and is a decreasing function in g to reflect its falling marginal benefits.[62] Combining both equations, the socially optimal provision of g requires the residents' MWTP for its preferred amount to exactly equal its MSC_g or $MWTP = MSC_g = 1$.

2.2.2. Property Tax, Fixed Housing Consumption and Fixed Business Capital

Consider now that there is a fixed amount of business capital $\overline{K}$ invested in local generic business property (assumed to be related mainly to retail activities).[63] This business capital in the community is assumed to be owned by a minority group of residents (or by non-residents and non-voters) whose preferences are not included in the

[61] The terminology is adopted following Dahlby and Wilson (2003) and Wildasin (1984).

[62] Lagrange multiplier λ, in general a function of $\lambda = \lambda(p, w)$, is assumed to be constant throughout this study to avoid shifts in the MWTP curve due to changes in municipal tax regimes. The assumption of $\partial\lambda / \partial p = 0$ has an implication for the demand elasticities which are now required to satisfy $\varepsilon_w^h = \varepsilon_w^\lambda$.

[63] The case without the presence of the business capital could be an isolated community with 'mail order' delivery of the private consumption good.

utility maximization problem of the local government.[64] In per capita terms, the business capital value may be expressed as $\bar{k} = \frac{\bar{K}}{N}$.

Adding non-residential property introduces two issues for the local authorities: cost of services to the businesses and tax shifting. The municipal government would want to collect property tax revenue from the local businesses at least sufficient to cover the cost of municipal services to that property and, more likely, it will see potential for revenue in excess of business cost (which is referred to as "rent") that can be used to subsidize publicly provided services to the other residents. In the latter case, business property taxes enable some combination of lower residential taxes and enhanced services to residential property. Residents are assumed to get no benefit from the presence of businesses other than those from their taxes: the advantages of having businesses in the community (such as reduced time to travel to stores) are balanced out by the disadvantages from intense retail activity (such as congested roads). Since the businesses themselves are likely to require some amount of government services, the cost of these services is modeled as a fixed fraction of the per capita capital value, $\bar{e}$. Subsequently, the property tax revenue from the businesses is assumed to at least cover the cost of providing the public services to them. If this is not the case, the presence of these businesses will be a burden to the local community as it would imply a subsidy from the residents to the businesses and so, presumably, business would be excluded.

Two additional assumptions are included in the analysis to follow. First, there is only one property tax rate that applies to both property types. In fact, some (provincial/state)

[64] Assuming that the business owners are simply outvoted rather than business owners are outsiders is more convenient for subsequent local welfare considerations.

legislation requires a non-differential property tax rate of municipalities to reduce potential business overtaxation. Here the assumption is used to avoid possible indeterminateness of the business property tax rate under fixed capital and is later relaxed. Second, the property tax on businesses is not passed on to local consumers through a higher price for the private good. There are at least a couple of reasons to justify this simplification: the tax may be already embodied in the price of x traded among individuals from home production or "mail order" delivery (as mentioned in a footnote above) in the absence of the local businesses or it may be too small relative to business sales to matter. In this situation, the introduction of business capital does not change anything in the individual maximization problem. Since housing consumption remains fixed at $\bar{h}$, $x = w - (1+p)\bar{h}$ and the indirect utility of each resident is still given by $U(\bar{h}, x^*, g) = V(\bar{h}, p, g)$.

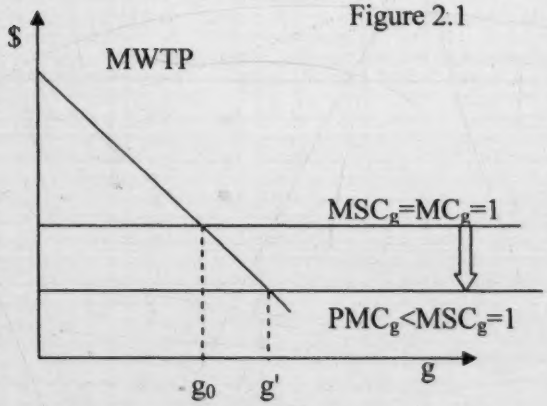
The opportunity for tax shifting originates from differences in voting powers and in servicing requirements of the two taxpayer groups. With the residents being the electorate, the residents' needs determine what services are provided by the municipal government. The outvoted business owners must simply contribute towards the expenditure on the composite per capita public output, $g^T = p\bar{h} + p\bar{k}$, whether they use all the services or not. Assuming, for example, that g^T includes fire stations, roads and schools, the businesses can only benefit from the first two, although the last one may be the most costly to deliver.[65] If the actual servicing cost of the commercial sector to the local government is $g^C = \overline{ek}$, then $g = g^T - g^C = p\bar{h} + p\bar{k} - \overline{ek} = p\bar{h} + (p - \bar{e})\bar{k}$ is allocated

[65] See Kitchen (2002) for data on US and Canadian cities.

to residential services, where $(p-\bar{e})\bar{k}$ is the amount of rents extracted from the retail businesses and transferred to the local voters (the fixed fraction cost of the public services to businesses, $\bar{e}$, has to be strictly less than the property tax rate, p).

The subsequent maximization of residents' utility with respect to p and g by the municipal authorities $L = V(\bar{h}, p, g) + \mu[p\bar{h} + (p-\bar{e})\bar{k} - g]$ yields a new equilibrium condition for the preferred level of g, $MWTP = PMC_g = \frac{\bar{h}}{\bar{h}+\bar{k}} = \frac{1}{1+\frac{\bar{k}}{\bar{h}}}$, where the ratio of the Lagrange multipliers is now defined as the perceived marginal cost of the public output or PMC_g.[66] Clearly, the optimal value of the MWTP to the households is now reduced to equal the lower PMC_g to the residents-voters, upon which their government representatives make their choices about the level of g to provide.[67] (Figure 2.1 illustrates a standard downward sloping MWTP curve and horizontal MSC_g and PMC_g lines.) This implies a higher quantity of the public service (g' versus g_0 in Figure 2.1). Since there are no changes in either the individual choices of h and x (h is fixed and x is separable from g) or in the cost of public production, both MCF and actual MC_g remain 1, ensuring $MSC_g = 1$. The increase in g

Figure 2.1



[66] The marginal cost is no longer social as businesses are not treated fairly. Instead the marginal cost is defined as perceived by the voters whose utility is maximized at the expense of local businesses.

[67] In this chapter (this section as well as sections 2.2.4 and 2.3.3) under non-differentiated property tax rates on residential and commercial property, the effect of business subsidy on the MWPT is considered small relative to its effect on MSC/PMC and is ignored for simplicity.

comes from the reduction in PMC_g to local citizens made possible by the revenue surplus collected from the property taxes on businesses in excess of the cost of the government services to them – that is, through distorted tax prices for overcharged businesses and "undercharged" or subsidized residents.[68]

There are several conclusions that can be drawn even from this simple model with two classes of properties. First, taxation of business property with distinct demands for municipal services at the same rate as residential property induces inefficiency from the viewpoint of social optimization. The socially efficient outcome requires $MWTP = MC_g$ for residential services, securing the optimal provision of g_0 in Figure 2.1. Under the voter utility maximization approach, there are no efficiency conditions to be satisfied and any politically acceptable measure may be implemented as long as it improves the wellbeing of the targeted group. Because rents from the commercial sector provide a subsidy to the residents by reducing the perceived marginal cost of their portion of the public output, g is overprovided at the new equilibrium (by the difference $\{g'-g_0\}$ in Figure 2.1). Second, the local government, with the same objective function as the average resident, is expected to accept such social non-optimality and to continue with the tax shifting practices to ensure the welfare enhancement of residents. Third, this demonstrates the case for benefit taxation of businesses via a separate property tax rate or user charges put forward, for example, by Kitchen and Slack (2003). However, the benefit taxation of business (when $p=\bar{e}$ or differential taxation with $\tilde{p}_b=\bar{e}$ where $\tilde{p}_b$ is set according to a benefit tax criteria) that could remove the distortion in the government

[68] This is consistent with the claim by Atkinson and Stern (1974) that, under certain conditions, public output may be overprovided (compared with full optimum). It depends on the choice of taxed goods or tax bases (here the inclusion of business property into residential utility maximization changes the optimal g).

optimization is an unlikely outcome: the politically conscious local government is not going to sacrifice its next term in office, presumably guaranteed with the subsidy provision, to fairness considerations for the electorally non-representative business owners.

2.2.3. Property Tax, Changing Housing Consumption and No Business Capital

In reality, the individual's housing consumption is likely to be sensitive to the municipal property tax rate. Depending on the magnitude of the property tax and local land policy, the possibility of alternative land use (e.g. for farming) and the desire for estate expansion by the residents themselves create a potential for changes in h. If the range of variation in h is wide enough to accommodate the voters' preferences, the new individual maximization $L = U(h, x, g) + \lambda[w - (1+p)h - x]$ with respect to both goods would yield the following optimal condition: $\frac{U_h}{U_x} = 1 + p$. Together with the individual budget constraint, this can be solved for the optimal quantities of both $h^* = h(p)$ and $x^* = x(p)$ and the indirect utility function $U(h^*, x^*, g) = V(p, g)$.

Now when the local benevolent government maximizes this indirect utility function with respect to the per capita quantity of the publicly provided good and the tax rate on housing subject to its balanced budget ($L = V(p,g) + \mu[ph(p) - g]$), the resulting individual's MWTP can be shown to equal MC_g=1 adjusted for MCF>1 due to the distorting taxation yielding: $MSC_g = \frac{h}{h + h_p p} = \frac{1}{1 + \varepsilon_p^h}$, where $\varepsilon_p^h = \frac{h_p p}{h} < 0$ is the property tax elasticity of housing. Since both MWTP and MSC_g are expected to be positive, then $1 + \varepsilon_p^h > 0$ and housing consumption should be relatively inelastic with

respect to its tax rate; in other words, we assume that $|\varepsilon_p^h|<1$.[69] (In this model, by originally trying to tax a consumption good where $|\varepsilon_p^h|\geq 1$, the government would be reducing the residents' utility by the provision of its services as $\text{MWTP} = \text{MSC}_g = \frac{1}{1+\varepsilon_p^h} < 0$. This may be considered to be one of the reasons for retaining the property tax after other taxes are introduced since added bases are expected to be more tax elastic compared with housing and can only support lower tax rates).

Under a variable h, the presence of a new negative term in the denominator ($\varepsilon_p^h < 0$) makes MCF and so MSC_g increasing functions in g to reflect the distortionary taxation (as p is raised to provide more g, housing consumption is reduced even further implying an increase in the absolute value of ε_p^h and, thus, a decrease in $1+\varepsilon_p^h$ - an upward sloping MSC_g in Figure 2.2a), whereas $\text{MC}_g = 1$ is unaffected. The new socially optimal value of $\text{MSC}_g = \frac{1}{1+\varepsilon_p^h}$ is greater than 1, indicating a new lower preferred level of g ($\tilde{g}$ with an upward sloping MSC_g versus g_0 with a constant

Figure 2.2a

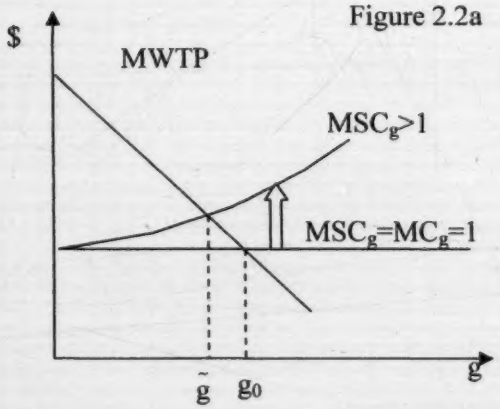
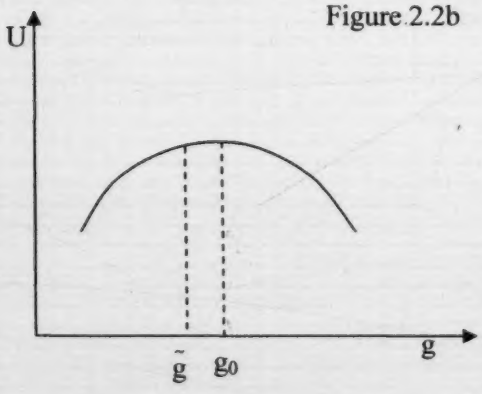


Figure 2.2b



[69] This condition also means that the government is on the upward sloping section of its Laffer curve for property tax revenues.

$MSC_g = MC_g = 1$ in Figure 2.2a) with the reduced supply given by $g_0 - \tilde{g}$.[70] The shrinkage in the provision of residential public services can be viewed as the local government's inability to reach the absolute maximum in voters' utility with respect to g (first best solution given by g_0 in Figure 2.2b) and its need to settle on the second best outcome instead ($\tilde{g}$ in Figure 2.2b).[71] This result is also consistent with the arguments that property taxation discourages investment in housing[72] (in contrast to the previous cases where the property tax essentially acted like a non-distortionary lump sum tax). As a result, the local government may be expected to use tax shifting practices, whenever possible, to promote residential property development.

2.2.4. Property Tax, Changing Housing Consumption and Fixed Business Capital

Consider now that there is a fixed amount of business capital $\overline{K}$ ($\overline{k} = \frac{\overline{K}}{N}$ in per capita terms) invested in business property in the municipality in question. Assuming $(p - \bar{e})\overline{k} > 0$, the presence of the generic businesses would be important for two major reasons. First, the presence of business capital provides a source of rent to the local government by which it can subsidize publicly provided services to residents. Second, that subsidy to the residential sector creates a potential for encouraging more h as (1+p) will be lower than otherwise.

The individual utility maximization problem is exactly the same as above. With the common p for residential and business property, the change is introduced through the

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[70] A similar second best outcome, with the provision of g falling short of its level under a lump-sum style tax, is also arrived at by Wilson (1991) under the conditions of distortionary taxation and distributional non-neutrality.

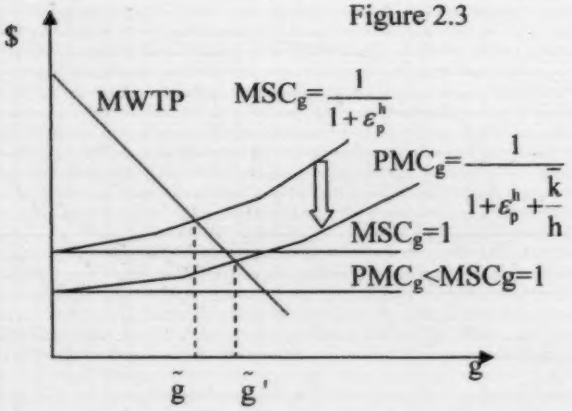
[71] Since the property tax is an unavoidable institutional constraint, the second best provision of g is actually the best (e.g., the utility maximizing alternative) under the institutional circumstances.

[72] This viewpoint is supported for Canadian municipal taxation in Kitchen (2002).

government budget constraint for residential services that now incorporates rents from the business sector $ph(p)+(p-\bar{e})\bar{k}=g$ and yields $PMC_g=\frac{h}{h+ph_p+\bar{k}}=\frac{1}{1+\varepsilon_p^h+\frac{\bar{k}}{h}}$.[73]

Clearly, for any similar values of non-constant tax elasticity of housing consumption $PMC_g=\frac{1}{1+\varepsilon_p^h+\frac{\bar{k}}{h}}<MSC_g=\frac{1}{1+\varepsilon_p^h}$, causing a non-parallel shift of the perceived marginal cost curve in Figure 2.3. As a result, a higher quantity of g is provided at the new equilibrium ($\tilde{g}'$ at $MWTP=PMC_g=\frac{1}{1+\varepsilon_p^h+\frac{\bar{k}}{h}}$ versus $\tilde{g}$ at $MWTP=MSC_g=\frac{1}{1+\varepsilon_p^h}$ in Figure 2.3). Whether g is under- or overprovided relative to its first best level (where $MSC_g=MC_g=1$) depends upon the elasticity of housing demand and on the relative amount of business property and its service cost.

Figure 2.3



To take a greater advantage of the presence of the business sector, the municipality may be tempted to charge different tax rates on residential and business property. Suppose the government is not legally restricted to a uniform property tax. By imposing a separate tax rate on business property, the local government could choose to maximize

[73] The expression MSC_g now includes a combination of a downward adjustment in PMC_g (due to the subsidy) and an upward adjustment in MCF (due to the tax distortion in housing consumption).

the tax revenue from this source – a strategy suggested in Helen Ladd's paper (Ladd, 1975). With business capital being fixed, any tax rate ($\tilde{p} > \bar{e}$) effectively results in a lump-sum transfer from businesses. Then the modified government budget, $ph + (\tilde{p} - \bar{e})\bar{k} = g$, reflects the presence of a per capita subsidy, $(\tilde{p} - \bar{e})\bar{k} > 0$, to local residential services. Since the MSC_g and PMC_g remain unchanged, the subsidy affects the citizens' MWTP (shifting it upward). Therefore, the city selects a larger quantity of g, part of which comes at no cost to them. Because the effective transfer from business frees some individual wage income that could be spent on housing and the private retail good, the magnitude of the MWTP for g shift may not be by the full amount of the original transfer. If the business property tax is set large enough to more than cover the cost of residential public services, lump sum dividends/refunds could be paid to local voters. In practice, however, for a number of political reasons this tax is more likely to be used to subsidize public services to residents. Under either business taxation strategy, it is the extent of possible tax shifting that shapes the new outcome and not optimality considerations.

The question of why there may be a rightward shift in the PMC curve instead a rightward shift in the MWTP curve is best addressed in the context of the fiscal illusion/flypaper literature. However, the literature still lacks consensus as for the full extent of transfer (grant) effects on public expenditures of lower level governments. The most recent insight into the issue is provided by Dahlby (2008). Following his logic, in the presence of fiscal illusion (that is, complete unawareness about the business rents), the voters do not expect and receive any tax reductions. Therefore, the business subsidy only reduces the cost of the public output provision, implying no rightward shift in the

MWTP curve but a rightward shift in the PMC curve. It is less clear what happens if full transparency of the public sector is assumed (or no fiscal illusion), which is the case in this model. It can be argued that the voters may perceive the business rents as paying for a certain amount of the public output g^* provided to them without distortion of taxation (in other words, the PMC is horizontal for g between 0 and g^*), and it is only when a tax is applied to them to finance additional g that the PMC begins to increase. As a result, the PMC curve shifts to the right. In contrast, one may also argue that when the local government is simply an agent of its voters, the complete absence of fiscal illusion leads to the voters' perception of the business rents as a part of their income "taxed" back to finance g^*. Then the PMC starts increasing from the very beginning and no rightward shift occurs. The adoption of the second perspective by this study is not expected to change the implications of any of the analysis.[74]

2.3. Two Taxes and One Publicly Provided Good

The original assumption of fixed housing consumption leaves no room for voter welfare improvement through the use of additional local taxes (in the absence of business property). A politically conscious municipal government would always prefer taxing the invariant housing expenditure, equivalent to lump-sum taxation, over any other tax base.[75] Once housing is assumed to be reasonably responsive to taxation, the local government may do better with more than one municipal tax by distributing the tax burden over the different economic activities within its jurisdictions. That is the situation investigated in this section.

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[74] The starting value of 1 for the MSC is also assumed here for convenience and the starting value of less than 1 for the PMC becomes a consequence of this assumption.

[75] Taxation of a fixed factor is logical if all individuals are homogeneous and their tax benefits are identical. Once individuals differ in income and/or benefits do not relate well to the fixed factor, its taxation may be less appealing for benefit related reasons.

the local budget. Similarly, $\text{MWTP} = \text{MSC}_{g(s)} = \dfrac{x}{[1+\varepsilon_s^x]x + \varepsilon_s^h \dfrac{p}{s} h} = \dfrac{1}{1+\varepsilon_s^x + \varepsilon_s^h \dfrac{\gamma_{ph}}{\gamma_{sx}}}$ from $\dfrac{\partial L}{\partial s}=0$, where ε_s^h and ε_s^x are the non-constant sales tax elasticities of the goods.

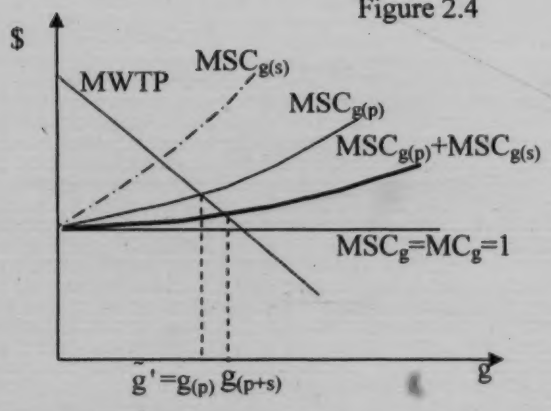
A straightforward inter-tax system comparison of the MSC_g expressions of $\text{MSC}_{g(p)} = \dfrac{1}{1+\varepsilon_p^h + \varepsilon_p^x \dfrac{\gamma_{sx}}{\gamma_{ph}}}$ with $\text{MSC}_g = \dfrac{1}{1+\varepsilon_p^h}$ from the similar case of only property taxation reveals the difference in their values due to a new term, $\varepsilon_p^x \dfrac{\gamma_{sx}}{\gamma_{ph}}$, in the denominator of the former. The term cannot be signed unless the relationship between the two consumption goods in the local economy is established. There are several obvious possibilities. If x and h are not related or, in other words, the cross price elasticity in the denominator is $\varepsilon_p^x = 0$,[79] the newly derived expression for the MSC_g in terms of the property tax is reduced back to $\text{MSC}_{g(p)} = \dfrac{1}{1+\varepsilon_p^h}$ and both MSC_g curves coincide. If, on the other hand, x and h are substitutes, $\varepsilon_p^x > 0$, then for any values of ε_p^h $\text{MSC}_{g(p)} = \dfrac{1}{1+\varepsilon_p^h + \varepsilon_p^x \dfrac{\gamma_{sx}}{\gamma_{ph}}} < \text{MSC}_g = \dfrac{1}{1+\varepsilon_p^h}$ corresponding to a shift of the MSC_g curve downwards from its original position (an additional affect of tax diversification due to goods substitutability). Finally, in the case of x and h complementarity ($\varepsilon_p^x < 0$), a universal reduction in both tax bases implies a new and higher MSC_g, as

[79] The assumption adopted in Brueckner and Saavedra (2001).

$MSC_{g(p)} = \dfrac{1}{1+\varepsilon_p^h + \varepsilon_p^x \dfrac{\gamma_{sx}}{\gamma_{ph}}} > MSC_g = \dfrac{1}{1+\varepsilon_p^h}$. Also a more complex interdependence may include h complementary with x but x substitutability with h or vice versa.

The comparison remains incomplete unless the impact of tax base expansion on the equilibrium quantity of public services is considered. The major modification to the utility maximizing public provision problem is introduced through the MCF function. Under this two-tax system, the taxes may contribute differently toward the provision of municipal services. A less elastic good is likely to raise more per capita tax revenue, as its consumption remains relatively less responsive to local taxation and can support a higher tax rate. Different degrees of tax distortions are reflected in the marginal cost of funds of both taxes, which, in turn, are passed on to their marginal social costs. Higher expected administrative costs of a more tax elastic demand for the private retail good are assumed to translate into $MSC_{g(s)}$ being higher than $MSC_{g(p)}$ for any level of g (the $MSC_{g(s)}$ curve positioned above the $MSC_{g(p)}$ in Figure 2.4). Because the two taxes are combined in use to finance the single composite public output, $MSC_{g(p)}$ and $MSC_{g(s)}$ can be regarded as cost components of their taxes in the overall MSC_g which is their horizontal sum; that is $MSC_{g(p)} + MSC_{g(s)} = MSC_g$ [80] and

Figure 2.4



[80] This sum holds exactly if $h_s + x_p = 0$.

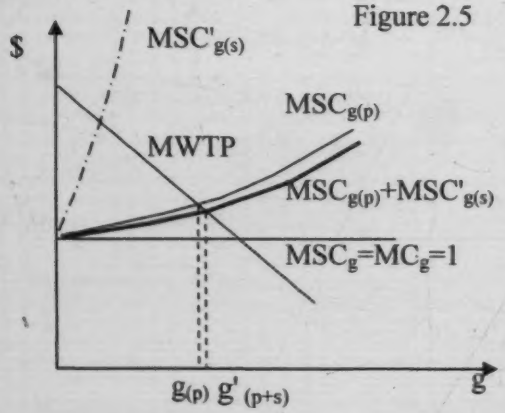
shown as $MSC_{g(p)} + MSC_{g(s)}$ in Figure 2.4. The equilibrium quantity of g is determined by the intersection point of $MSC_{g(p)} + MSC_{g(s)}$ with MWTP ($g_{(p+s)}$ in Figure 2.4). If, for simplicity, it is assumed that $MSC_{g(p)} < MSC_{g(s)}$ throughout, then the point of $MWTP = MSC_{g(p)}$ with the quantity $g_{(p)}$ indicates the optimal provision of the public services under a single property tax system. The residents are unwilling to change $g_{(p)}$ until a sales tax is introduced. With the incorporation of the sales tax into the system (as depicted in Figure 2.4), the marginal benefit of $g_{(p)}$ happens to exceed the new overall $MSC_g = MSC_{g(p)} + MSC_{g(s)}$ prompting the residents to accept more g (a move to $g_{(p+s)}$). This greater provision of g and, thus, higher public expenditure stem from diversification of the local tax system. The values at which MSC_g equal MWTP also determines the quantities of g that each tax should finance. That is, the distribution of the tax burden between the property and sales taxes should be that at the g each is able to finance or $MSC_{g(p)} = MSC_{g(s)} = MSC_g$, where MSC_g and MWTP intersect. Consequences are that, first, shifting part of the tax burden to the sales tax (with infra-marginal lower overall MCF) lowers the total MSC_g, bringing the latter closer to the quantity of g provided (optimally) under non-distortionary taxation. Second, collecting tax revenue from the two sources promotes an option of a decrease or, at least, non-increase in the property tax rate.

In general, when the condition $h_s = x_p = 0$ does not hold, the horizontal summation of the $MSC_{g(p)}$ and $MSC_{g(s)}$ curves is less clearly defined. The reason is that the cost components now depend on the other tax and become more complex. The optimal

combination of taxes that equates their respective MSCs starts to vary as the tax rates are increased to raise more revenue and provide a higher level of g. Still one can think of the $MSC_{g(p)}$ and $MSC_{g(s)}$ curves as equilibrium curves after taking account of the interdependence effects. Although similar diagrams will still be employed in this more complex case to aid the analysis, they are more illustrative of the mathematical model and the decision-making processes of the local governments and are no longer definitive.

The above-discussed advantages of tax diversification may not be realized under certain conditions. The larger is the difference between $MSC_{g(p)}$ and $MSC_{g(s)}$,[81] the less likely a visible impact on the equilibrium quantity of g can be achieved through the introduction of the sales tax. If $MSC_{g(s)}$ were instead $MSC'_{g(s)}$ (see Figure 2.5), there would be little incentive to add g beyond $g_{(p)}$ and the sales tax option would not likely be exercised (by the envelope theorem, it would produce only a small effect on individual utility making its implementation not worth all the administrative costs and, perhaps, political troubles for the municipal government). This could potentially explain why not all jurisdictions with access to a local sales tax choose to use it to complement the revenue from the property tax (the case of some U.S. municipalities in South Carolina and Minnesota, for example).

Figure 2.5



[81] For example, if h and x are substitutable in p and complementary in s ($\varepsilon_p^x > 0$ and $\varepsilon_s^h < 0$).

Assuming the introduction of the sales tax does occur, it is important to understand how relative tax rates are chosen when the municipal government's priority is its voters' wellbeing. Straightforward elimination of the tax distortion from the individual utility maximization condition $\frac{U_h}{U_x} = \frac{1+p}{1+s}$ seems to suggest a "neutral" tax solution of $\frac{p}{s} = 1$ or $p = s$ (see *Property and Sales* in Appendix 2.9).[82] In practice, the outcome with tax rate uniformity would better apply to a model with leisure.[83] Since no distinction between leisure and work time is made in this model, the condition $p = s$ does not have to hold. Instead, resident utility maximization is expected to shape the government's choices of tax rates, providing the second best solution of a more typical world.

Remembering that equilibrium values of either marginal social cost of g are given in terms of the ratio of the constant Lagrange multipliers ($MSC_{g(p)} = \frac{\mu}{\lambda}$ and $MSC_{g(s)} = \frac{\mu}{\lambda}$), both MSCs are equalized at the optimum. Or using their general expressions, $\frac{1}{1+\varepsilon_p^h + \varepsilon_p^x \frac{\gamma_{sx}}{\gamma_{ph}}} = \frac{1}{1+\varepsilon_s^x + \varepsilon_s^h \frac{\gamma_{ph}}{\gamma_{sx}}}$, which can be simplified to $\frac{p}{s} = \frac{xx_p - hx_s}{hh_s - xh_p}$ (see *Property and Sales* in Appendix 2.9). This condition is equivalent to the Ramsey rule under taxation with non-zero cross tax elasticities.[84] It describes the socially optimal tax rate combination the residents-voters themselves will want to achieve when offered a two-tax option. In the extreme case of both goods being unrelated, the Ramsey expression above becomes $\frac{p}{s} = \frac{hx_s}{xh_p} = \frac{x_s/x}{h_p/h}$ indicating that the good which is less responsive to its own tax

[82] This type of solution is derived following the approach in Brueckner and Saavedra (2001).
[83] See Deaton (1979), Deaton and Stern (1986).
[84] The rule is initially derived by Ramsey (1927) and is further developed by Hicks (1947) and others.

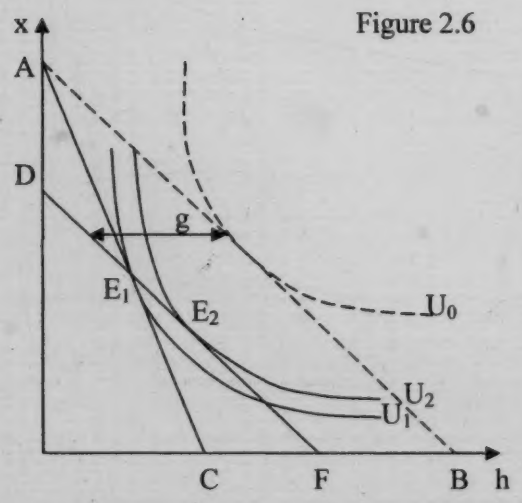
(plausibly, housing) is taxed at a higher rate. Also since $MSC_{g(p)}$ can be written as

$$MSC_{g(p)} = \frac{h}{[1+\varepsilon_p^h]h + \varepsilon_p^x \frac{s}{p} x} = \frac{h}{g_p} \quad \text{and} \quad MSC_{g(s)} \text{ as } MSC_{g(s)} = \frac{x}{[1+\varepsilon_s^x]x + \varepsilon_s^h \frac{p}{s} h} = \frac{x}{g_s}$$

(where g_p and g_s are the partial derivatives of the publicly provided good with respect to both taxes), the alternative way to express the Ramsey condition is $\frac{x}{g_s} = \frac{h}{g_p}$. At the social equilibrium, the local government would make the ratio of the marginal expenditures equal to the ratio of the quantities of the goods chosen for individual consumption, $\frac{g_p}{g_s} = \frac{h}{x}$.

2.3.2. Comparison of One and Two Tax Systems under Changing Housing Consumption

Figure 2.6



In a pre-tax equilibrium, the individual budget constraint $w = h + x$ corresponds to the line AB with a 45^0 slope in Figure 2.6.[85] With no tax distortion in the economy and with both prices normalized to 1, the optimal condition is $\frac{U_h}{U_x} = 1$, with indifference curve U_0 tangent to that budget line. Potential welfare improvement from public services provision results in municipal government action when the utility from having g more than compensates for the

[85] The Figure 2.6 is only valid if g is separable from h and x, which is expected to be the case for the assumption of g separability in the utility function to hold.

disutility from taxation. Once the provision of g and the taxes to finance g are in place, each resident finds herself on a lower budget constraint and indifference curve in terms of h and x because now a part of their resources is collected and used for the publicly provided good (which is an external variable in Figure 2.6 and its changes cannot be shown). With the property tax only, the optimal choice is given by $\frac{U_h}{U_x} = 1 + p$, depicted as the budget constraint AC and the tangent indifference curve U_1 (point E_1 in Figure 2.6). The tax distortion, thus introduced into the price ratio, makes the individuals worse off by putting them on a lower indifference curve. To illustrate the point, imagine the existence of a lump sum tax that could raise the same revenue.[86] It would simply reduce the budget constraint to DF without changing its slope. Then with the same quantity of g being provided (indicated by the distance between AB and DF in Figure 2.6), there is an improvement in utility from U_1 to U_2 (from point E_1 to point E_2 in Figure 2.6). Since lump sum taxes are not common occurrences in the real world, let us instead consider the property and sales taxes that collect the same tax revenue. The individual choice condition becomes $\frac{U_h}{U_x} = \frac{1+p}{1+s}$, clearly $\frac{1+p}{1+s} < 1 + p$. Then the welfare maximizing local government can manipulate the tax rates to fit the voters' consumption choices given by their preferences in such a way that the new and flatter budget line, passing through the same point E_1, would allow for a utility level higher than U_1 to be achieved. If the voters" utility maximization dictates $\frac{1+p}{1+s} = 1$ or $p = s$, the budget line coincides with DF and the optimal/lump sum outcome E_2 is reached (something not at all possible under a single

[86] In the context of the choice between h and x, an ad valorem tax on wage income is like a lump sum tax on wages. Imposing a tax rate t on wage income to finance the public output reduces its net amount left to be spent on consumption goods to (1-t)w but does not distort individual choices between h and x.

tax). If $\frac{1+p}{1+s} \gtrless 1$, the anticipated improvement in the residents' wellbeing may not be the lump-sum tax optimal point, since $p \neq s$, but will still result in a reduction of the tax distortion. Hence, the local government and taxpayers could be expected to prefer a two tax system over a single tax system for financing the publicly provided good g.

In reality, once the second tax is introduced, the level of tax revenue should be allowed to change. The magnitude of its increase in the case of unrelated consumption goods given by the downward shift in the overall marginal social cost curve in Figure 2.4 (when compared with only property taxation, $MSC_{g(p)} + MSC_{g(s)} < MSC_{g(p)}$ at any g) would be consistent with a more efficient (a less distorting) tax system, which makes the greater provision of g ($g_{(p+s)} > g_{(p)}$ in Figure 2.4) more attractive for the local government and residents because of the reduced tax distortion.

2.3.3. Property and Sales Taxes, Changing Housing Consumption and Fixed Business Capital

The addition of business property to this set up does not induce any changes in the individual maximization. Rather, with a common property tax rate applied to business and residential property, there is a change to the government's maximization problem through its modified budget constraint: $g = ph(p,s) + sx(p,s) + (p - \bar{e})\bar{k}$. Then, from the F.O.C., $\frac{\partial L}{\partial p} = 0$, $PMC_{g(p)} = \frac{1}{1 + \varepsilon_p^h + \varepsilon_p^x \frac{\gamma_{sx}}{\gamma_{ph}} + \frac{\bar{k}}{h}}$ includes a new positive term $\frac{\bar{k}}{h}$. Clearly, for the same values of ε_p^h, ε_p^x, γ_{ph} and γ_{sx}, a subsidy from businesses to the citizen-voters is introduced through a reduction in the perceived marginal cost of property tax

funds for residential public services when there is a uniform p applying to all property ($PMC_{g(p)} = \frac{1}{1+\varepsilon_p^h + \varepsilon_p^x \frac{\gamma_{sx}}{\gamma_{ph}} + \frac{\bar{k}}{h}} < MSC_{g(p)} = \frac{1}{1+\varepsilon_p^h + \varepsilon_p^x \frac{\gamma_{sx}}{\gamma_{ph}}}$). Although from $\frac{\partial L}{\partial s}=0$ $MSC_{g(s)} = \frac{1}{1+\varepsilon_s^x + \varepsilon_s^h \frac{\gamma_{ph}}{\gamma_{sx}}}$ remains unchanged, the overall $PMC_g = PMC_{g(p)} + MSC_{g(s)}$ now lies lower than the initial overall MSC_g. As business taxation does not imply any change in voters' MWTP, a higher equilibrium quantity of g results.[87]

In addition to lowering the perceived marginal cost of funds raised through property taxation, the presence of taxable business capital can also be shown to increase the property to sales tax ratio of the Ramsey condition. The equality of the newly derived expressions for $PMC_{g(p)}$ and $MSC_{g(s)}$ simplifies to $\frac{p}{s} = \frac{xx_p - hx_s}{hh_s - xh_p - \frac{\bar{k}x}{p}}$. With $\frac{\bar{k}x}{p} > 0$, $\frac{xx_p - hx_s}{hh_s - xh_p - \frac{\bar{k}x}{p}} > \frac{xx_p - hx_s}{hh_s - xh_p}$ for similar values of h, x, h_p, h_s, x_p, x_s and there is an observed tendency to inflate the property tax relative to the sales tax. A rise or non-reduction in p under the introduction of the sales tax has a relatively small negative affect on the residents' utility in xh space, but a relatively large positive effect on the provision of public services (through an increase in the net tax revenue collected from the commercial sector) and, thus, on the voters' overall wellbeing, more than compensating for the disutility from a now higher than otherwise property tax rate. That is why, in the

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[87] If the business property were taxed at a separate tax rate $\tilde{p}$, there would be a rightward shift in MWTP schedule to account for a fixed amount of revenue from the business sector towards the residential g.

case of uniform property taxation, the possibility of rent extraction is expected to make straightforward equalization of tax rates, $p = s$, a socially undesirable outcome (see *Example* in Appendix 2.9).

2.4. Heterogeneous Individuals and the Role of the Median Voter

Heterogeneity of residents' preferences or incomes complicates real-life decision making and economic modeling. That demands for public services may vary across individuals needs acknowledgement and some discussion. Consider a relatively simple case where preferences are the same, but incomes differ. So if we keep the assumption about identical preferences, utility seperability in g and no business capital, but relax the assumption about identical income and instead let the exogenously determined earnings vary among the local residents, the quantities of h and x chosen for consumption will change. Now, under a single tax system, $\bar{h}(p) \neq h_i(p)$ for $\forall i$ or average housing consumption is no longer representative. Depending on whose utility function the government will prefer to maximize, $MWTP^i = \frac{h_i}{[1+\varepsilon_p^{\bar{h}}]\bar{h}} = MSC_g^i$ ($MSC_g^i = \frac{\mu}{\lambda_i}$ and $MWTP^i = \frac{V_g}{\lambda_i}$), where the index i stands for individual i. It is typically assumed that government responds to the preferences of the median voter.[88] If a typical pattern of income distribution – with the income of the median citizen being less than the income of the average citizen – is assumed, it follows that $h_{av} > h_m$ and so $MWTP^{av} > MWTP^m$ for the same values of $\varepsilon_p^{\bar{h}}$. Given the uniform provision of g to all individuals, but their varying contributions towards its expenditure, we find that the socially efficient outcome

[88] Meltzer and Richards (1981).

can no longer be easily defined.[89] The modified Samuelson rule specifies two conditions for provision and taxation: each individual has to pay her marginal value for the quantity g^*, which is her tax price p_i, and the tax prices have to sum up to its average marginal cost of funds $\sum_i MWTP^i = N \times MSC_g^*$. Tax prices of g can be expected to vary because households with differing incomes are likely to choose differing h and so the property tax, for example, required to fund an additional unit of g will differ among households. In turn, differing tax prices yield failure at the municipal level to agree on the same quantity of the publicly provided good g^*. If g^* were a political outcome, the redistribution resulting from the tax and expenditure activities within the local jurisdiction promotes inconsistency with the advocated principle of benefit taxation and inability to reach a Lindahl type equilibrium. Thus, the heterogeneous economy is unlikely to achieve an efficient g.

The heterogeneity of the individuals presents a problem for a democratic local government. Because its members care about being re-elected, they would want to maximize the utility of a representative resident (the median voter) to win the most possible votes. If the income distribution implies that the majority of residents are earning lower-than-average wages, then a median resident seems an attractive candidate for a representative voter whereas an average one will not represent the majority's preferences.

At the same time, the use of the median voter's preferences can be expected to result in a socially inefficient outcome. The equilibrium quantity of g arrived at by the

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[89] The social optimum remains unchanged: $MWTP^i = MSC_g^i = MC_g = 1$ but is out of reach due to both distortionary property taxation and differences in the marginal benefits from g to the individuals.

government comes from the condition that the MWTP of the median voter must be equal to the marginal cost of funds derived using her marginal utility of income: $MWTP^m = MSC_g^m$, where $MSC_g^m = \frac{h_m}{\bar{h}} MSC_g^{av}$ (with $MSC_g^{av} = \frac{1}{1+\varepsilon_p^{\bar{h}}}$). The bigger is the difference in income and, thus, in housing consumption between the median and average individuals, the more likely the MSC_g^m is less than actual MSC_g. If they are substantially apart, the quantity of g to be demanded by the median voter would be higher at MSC_g^m than if her $MSC_g = MC_g = 1$. Since both the median and average voter's situations do not coincide with the socially optimal condition (unlike the case of identical individuals and non-distorting taxes), nothing can be said about how MWTP, MC and g derived from either voter's utility maximization compares to the efficient provision.

The introduction of differences in resident preferences adds significant complexity to the analysis of municipal taxation. If there is no majority group with at least similar preferences, the local government in isolation may face serious difficulty. Such an extreme situation results in an effective subdivision of the municipal government as people sort themselves into more homogeneous groups or government differentiates services and taxes among groups for more satisfactory public service provision. After such sorting has taken place, minimized differences in tastes and incomes become consistent with the analysis of homogeneous individuals.

The theoretical analysis conducted in this chapter is expected to be valid for its empirical application to a diverse population. For example, a two tax system should remain less distorting and utility improving at the individual level, although a fully socially efficient equilibrium is not realized. In this sense, the median voter utility

maximization model exists as a good parallel to the identical/representative voter model assumed in this chapter.

2.5. Conclusions

There are a number of important conclusions that can be drawn even from the simple model and its extensions presented in this section.

Fixed individual expenditure on housing does not have to reflect the reality of an isolated jurisdiction. In fact, this assumption makes it difficult to justify the use of other taxes that tend to distort the choices of the variable quantity consumption good. Once housing expenditure is allowed to change, the MSC_g is expected to increase ($MSC_g > 1$). This creates an opportunity for the municipality to pursue tax diversification.

The presence of a relatively immobile and potentially underrepresented business sector can be expected to result in its taxation to subsidize the residential sector.

A two tax system has the potential of being more efficient and utility enhancing. A higher level of individual wellbeing can be achieved by reducing the original tax distortion in the price ratio while keeping the tax rates on different consumption goods distinct in value. When the benefits from the publicly provided good are unspecified (i.e. g does not appear in the demand functions for the consumption goods), a two tax system simply allows the tax burden to be distributed over the different economic activities.

Accessing additional tax sources is expected to result in the expansion of public services even without subsidies from the business sector. Alternatively, an opportunity for rent extraction from the businesses under the non-differentiated property tax is expected to yield a relatively higher equilibrium property tax rate and a further expansion of public services.

Any heterogeneous characteristics of residents are expected to induce sorting of people into more homogeneous groups. Following such sorting, differences in preferences and incomes become minimized and can be analyzed as in the case of homogeneous individuals.

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2.7. *Appendix*

Property and Sales Taxes (Under Changing Housing Consumption and No Business Capital)

The first step is the utility maximization by the residents with respect to the quantities of h and x, given their budget constraint:

$$L = U(h,x,g) + \lambda[w-(1+p)h-(1+s)x]$$

$$\left.\begin{aligned}\frac{\partial L}{\partial h} &= U_h - \lambda(1+p) = 0\\ \frac{\partial L}{\partial x} &= U_x - \lambda(1+s) = 0\end{aligned}\right\} \Rightarrow \frac{U_h}{U_x} = \frac{1+p}{1+s} \qquad \text{(A1)}$$

$$\frac{\partial L}{\partial \lambda} = w-(1+p)h-(1+s)x = 0. \qquad \text{(A2)}$$

Equations (A1) and (A2) can be combined to solve for $h^* = h^*(p,s)$ and $x^* = x^*(p,s)$ (when the utility function is assumed separable in g) and then for $V(h^*,x^*,g) = V(p,s,g)$ where w is suppressed for simplicity.

The second step involves the maximization of individual utility by the government with respect to both taxes and g, given its balanced budget constraint:

$$L = V(p,s,g) + \mu[ph(p,s)+sx(p,s)-g]$$

$$\frac{\partial L}{\partial p} = V_p + \mu[p\frac{\partial h}{\partial p}+s\frac{\partial x}{\partial p}+h] = 0 \qquad \text{(A3)}$$

$$\frac{\partial L}{\partial s} = V_s + \mu[p\frac{\partial h}{\partial s}+s\frac{\partial x}{\partial s}+x] = 0 \qquad \text{(A4)}$$

$$\frac{\partial L}{\partial g} = V_g - \mu = 0 \qquad \text{(A5)}$$

$$\frac{\partial L}{\partial \mu} = g-ph-sx = 0.$$

From the individual's maximization problem, it can be shown that $V_p = -\lambda h$ and $V_s = -\lambda x$ by the envelope theorem. Then equations (A3) and (A4) can be, respectively, rewritten as:

$$MSC_{g(p)} = \frac{\mu}{\lambda} = \frac{h}{[1+\varepsilon_p^h]h+\varepsilon_p^x\frac{s}{p}x} = \frac{1}{1+\varepsilon_p^h+\varepsilon_p^x\frac{\gamma_{sx}}{\gamma_{ph}}} \qquad \text{(A6)}$$

$$MSC_{g(s)} = \frac{\mu}{\lambda} = \frac{x}{[1+\varepsilon_s^x]x+\varepsilon_s^h\frac{p}{s}h} = \frac{1}{1+\varepsilon_s^x+\varepsilon_s^h\frac{\gamma_{ph}}{\gamma_{sx}}} \qquad \text{(A7)}$$

where $\varepsilon_p^h, \varepsilon_p^x$ are tax elasticities of the consumption goods and γ_{ph}, γ_{sx} are the tax revenue shares of both taxed goods in the government budget. Both equations (A6) and (A7) describe the same equilibrium values of the marginal social costs from the different

sources that can be denoted as $\frac{\mu}{\lambda} = MSC_{g(p)} = MSC_{g(s)} = MSC_g^*$. Then, from equation (A5) the residential marginal willingness to pay for g can be shown to equal the equilibrium value of the overall MSC_g:

$$MWTP = \frac{V_g}{\lambda} = \frac{\mu}{\lambda} = MSC_g^*. \qquad (A8)$$

Equating (A6) and (A7) yields $\frac{1}{1+\varepsilon_p^h + \varepsilon_p^x \frac{\gamma_{sx}}{\gamma_{ph}}} = \frac{1}{1+\varepsilon_s^x + \varepsilon_s^h \frac{\gamma_{ph}}{\gamma_{sx}}}$. This can be rewritten as $\varepsilon_p^h + \varepsilon_p^x \frac{\gamma_{sx}}{\gamma_{ph}} = \varepsilon_s^x + \varepsilon_s^h \frac{\gamma_{ph}}{\gamma_{sx}}$ or $\varepsilon_p^x \frac{\gamma_{sx}}{\gamma_{ph}} - \varepsilon_s^x = \varepsilon_s^h \frac{\gamma_{ph}}{\gamma_{sx}} - \varepsilon_p^h$. Simplifying even further, $\frac{x_p p}{x}\frac{sx}{ph} - \frac{x_s s}{x} = \frac{h_s s}{h}\frac{ph}{sx} - \frac{h_p p}{h}$ or $s(\frac{x_p}{h} - \frac{x_s}{x}) = p(\frac{h_s}{x} - \frac{h_p}{h})$ and then to $\frac{p}{s} = \frac{\frac{x_p}{h} - \frac{x_s}{x}}{\frac{h_s}{x} - \frac{h_p}{h}} = \frac{xx_p - hx_s}{hh_s - xh_p}$. The latter condition may be interpreted as the Ramsey optimal taxation rule with non-zero cross tax elasticities ($x_p, h_s \neq 0$). In fact, if the cross tax elasticities are assumed to be zero, the expression simplifies to $\frac{p}{s} = \frac{hx_s}{xh_p} = \frac{x_s/x}{h_p/h}$ indicating that the local government chooses to tax the less elastic good at a higher rate.

The optimal provision of g analysis provides another viewpoint on local government performance. With only one local tax available to the government both approaches coincide, but the presence of the additional tax complicates the model and the approaches diverge in their results and recommendations. Following Brueckner and Saavedra (2001), with two taxes and two consumption goods there are two conditions that can be derived to check on the efficiency of public delivery. Substituting both constraints $x = \frac{w-(1+p)h(p,s)}{1+s}$ and $g = ph(p,s) + sx(p,s)$ into the individual's utility, $U(h,x,g) = U(h(p), \frac{w-(1+p)h(p)}{1+s}, ph(p) + s\frac{w-(1+p)h(p)}{1+s})$, and differentiating it with respect to p yields $U_h h_p + U_x[-\frac{h+(1+p)h_p}{1+s}] + U_g[h + ph_p - \frac{s}{1+s}(h+(1+p)h_p] = 0$. Dividing by U_x and remembering that $\frac{U_h}{U_x} = \frac{1+p}{1+s}$ gives $\frac{1+p}{1+s}h_p - \frac{h+(1+p)h_p}{1+s} + \frac{U_g}{U_x}[\frac{(1+s)(h+ph_p) - s(h+(1+p)h_p)}{1+s}] = 0$, which can be simplified to

$$\frac{U_g}{U_x} = \frac{h}{h + (p-s)h_p} = \frac{1}{1 + \frac{p-s}{p}\varepsilon_p^h}. \qquad \text{(A9)}$$

In a similar way, from $U(h,x,g) = U(\frac{w-(1+s)x(s)}{1+p}, x(s), p\frac{w-(1+s)x(s)}{1+p} + sx(s))$ the expression for $\frac{U_g}{U_h}$ can be derived as:

$$\frac{U_g}{U_h} = \frac{x}{x + (s-p)x_s} = \frac{1}{1 + \frac{s-p}{s}\varepsilon_s^x}. \qquad \text{(A10)}$$

From (A9), it is obvious that if $\varepsilon_p^h \neq 0$, the efficient provision of g can be achieved by equating both tax rates, $p = s$. Otherwise, if $p > s$, then $\frac{U_g}{U_x} > 1$ and the analysis points out the underprovision of g in terms of x (which would also be consistent with overprovision of g in terms of h). Because the benefits from the publicly provided good are not explicitly related to h and x, the tax burden is viewed as disproportionately shifted to homeowners through a higher tax rate. If $p < s$, $\frac{U_g}{U_x} < 1$ and g is overprovided in terms of x (and, thus, underprovided in terms of h). In this case, the tax burden is perceived as disproportionately falling on local residents as consumers. The opposite is true for the (A10) condition.

Example

The basic set up includes simple preferences, $U = h \times x + g$, two existing municipal taxes and a business capital presence in the municipality.

First, the utility maximization by the local residents $L = h \times x + g + \lambda[w - (1+p)h - (1+s)x]$ yields $\frac{x}{h} = \frac{1+p}{1+s}$ or $x = \frac{1+p}{1+s}h$. This, combined with the individual budget constraint, $w = (1+p)h + (1+s)\frac{1+p}{1+s}h$, allows one to solve for the resident demand for housing, $h^* = \frac{w}{2(1+p)}$, and then for compound private good, $x^* = \frac{w}{2(1+s)}$ (notice that both demands are affected only by their own taxes). Substituting these into the utility function, the indirect utility function is derived, $V = h^* \times x^* + g = \frac{w}{2(1+p)} \times \frac{w}{2(1+s)} + g = \frac{w^2}{4(1+p)(1+s)} + g$.

Second, the government maximization of the voters' indirect utility subject to the balanced budget constraint when the government does not render any services to businesses or $\bar{e}=0$, $L=\frac{w^2}{4(1+p)(1+s)}+g+\mu[p\frac{w}{2(1+p)}+s\frac{w}{2(1+s)}+p\bar{k}-g]$ produces:

$$-\frac{w^2}{4(1+p)^2(1+s)}+\mu[\frac{w}{2(1+p)}-\frac{wp}{2(1+p)^2}+\bar{k}]=0 \qquad (A11)$$

$$-\frac{w^2}{4(1+p)(1+s)^2}+\mu[\frac{w}{2(1+s)}-\frac{ws}{2(1+s)^2}]=0 \qquad (A12)$$

$$1-\mu=0. \qquad (A13)$$

From (A11) and (A13), it follows $\frac{w^2}{4(1+p)^2(1+s)}=\frac{w(1+p)-wp+2\bar{k}(1+p)^2}{2(1+p)^2}$ or $\frac{w^2}{2(1+s)}=w+2\bar{k}(1+p)^2$. Similarly, from (A12) and (A13), $\frac{w^2}{4(1+p)(1+s)^2}=\frac{w(1+s)-ws}{2(1+s)^2}$ or $\frac{w}{2(1+p)}=1$ and $p^*=\frac{w}{2}-1$. Combining this result with $\frac{w^2}{2(1+s)}=w+2\bar{k}(1+p)^2$, the optimal sales tax rate is obtained as $s^*=\frac{w}{2+\bar{k}w}-1$.

Using general forms of the tax rate expressions, $\frac{p^*}{s^*}=\frac{\frac{w}{2}-1}{\frac{w}{2+\bar{k}w}-1}>1$ because $2<2+\bar{k}w$ and, thus, $\frac{w}{2}>\frac{w}{2+\bar{k}w}$. However, to assign adequate values to per capita business investment and wage income, the scale of the consumption variables has to be taken into consideration. Since $h^*=\frac{w}{2(1+p)}$ and $p^*=\frac{w}{2}-1$, the optimally chosen housing will always remain 1, $h^*=\frac{w}{2(1+p)}=\frac{w}{2(1+\frac{w}{2}-1)}=\frac{w}{w}=1$. Then, the per capita value of business capital has to be less than one, as it is expected that $h>\bar{k}$. In turn, this also indicates that annual wage income has to be higher than 1. If $w=2.5$ and $\bar{k}=0.1$, the tax ratio becomes $\frac{p^*}{s^*}=\frac{\frac{2.5}{2}-1}{\frac{2.5}{2+0.1\times2.5}-1}=\frac{0.25}{0.(11)}\approx2.25$. Compellingly, the equilibrium property tax rate in this set up remains the same with or without business capital, $p^*=\frac{2.5}{2}-1=0.25$, as it is completely independent of $\bar{k}$. So it is the lower sales tax rate introduced by the local government when business property is available as a part of the property tax base that causes the ratio to go up in absolute value. Instead of introducing

the sales tax rate equal to the property tax rate, with businesses present within the municipal borders, the local authorities prefer to go with a smaller sales tax rate (assumed to be completely borne by the citizen-voters). Anyway, keeping the same property tax brings higher tax revenue from residential and commercial property combined and ensures the tax burden shifting to the business sector.

Property Tax and Specified Benefits (Under Changing Housing Consumption and No Business Capital)

Both Atkinson and Stern (1974) and Wildasin (1984) point out the importance of the degree of complementarity of the public output with the taxed good(s) (under non-separability of individual preferences). Wilson (1991) investigates this claim further to see if the level of public provision in a second best economy (with distortionary commodity taxes) is more likely to fall short or to exceed the level in a first best economy (with a lump-sum tax). Applying his idea to the present model, $MWTP^b = MSC_g^b = \frac{1-\varepsilon_g^h}{1+\varepsilon_p^h}$ can be greater, equal or less than its socially optimal value of 1 under non-distortionary taxation depending on how the values of ε_g^h and $|\varepsilon_p^h|$ are ranked. First, if $\varepsilon_g^h < -\varepsilon_p^h$ or, in other word, the tax distortion proves to be greater than the benefits from the public output, $1-\varepsilon_g^h > 1+\varepsilon_p^h$ and $\frac{1-\varepsilon_g^h}{1+\varepsilon_p^h} > 1$. The equilibrium provision of g falls short of the first best ($g'_b < g_0$ in Figures 2.7a and 2.7b). Second, if $\varepsilon_g^h = -\varepsilon_p^h$ or the tax distortion equals the benefits from the public output, $\frac{1-\varepsilon_g^h}{1+\varepsilon_p^h} = 1$. Such equilibrium provision of g becomes the first best (exactly g_0 in Figures 2.7a and 2.7b). Because it completely eliminates the tax distortion from the economy, it also guarantees pure benefit taxation (a difference with Wilson (1991) where tax distortion cannot be removed this way). Third, if $\varepsilon_g^h > -\varepsilon_p^h$ or the tax distortion is smaller than the benefits from public output,

Figure 2.7a

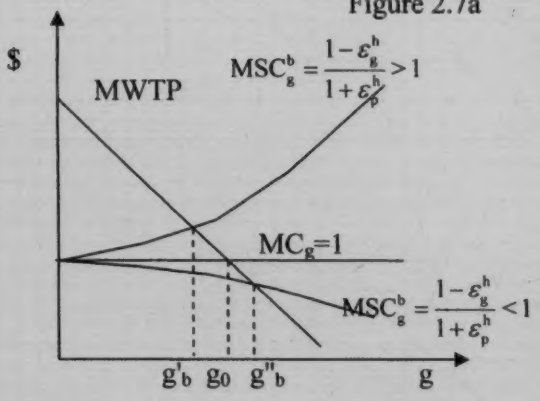
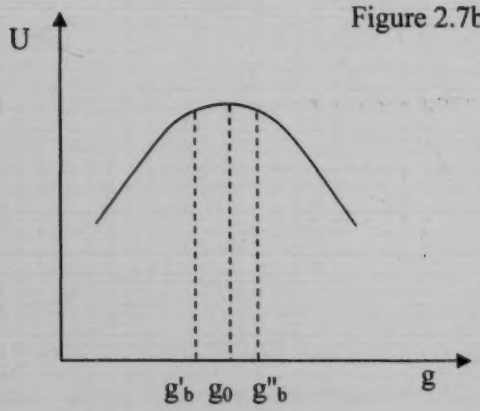


Figure 2.7b



$1-\varepsilon_g^h < 1+\varepsilon_p^h$ and $\frac{1-\varepsilon_g^h}{1+\varepsilon_p^h} < 1$. Then the equilibrium provision of g is higher than the first best level ($g''_b > g_0$ in Figures 2.7a and 2.7b). The resulting downward sloping MSC_g^b (shown as $MSC_g^b = \frac{1-\varepsilon_g^h}{1+\varepsilon_p^h} < 1$ in Figure 2.7a) requires a high degree of complementarity between housing and the publicly provided good, possible only if x and p are negatively related: every increase in p augments g and that, in turn, boosts the consumption of h implying less wage income spent on x. This difficulty combined with a lower utility level (the utility for g''_b as opposed to the utility for g_0 in Figure 2.7b) leads Gaube (2005) to conclude that, for most cases, the actual public expenditure should not exceed the level of non-distortionary taxation.

Chapter 3. Municipal Tax Choices in a Multi-Jurisdictional Competitive Environment

3.1. Introduction

The growth in the literature on interjurisdictional interactions – commonly referred to as the tax competition literature – has been intense during the last 20 years and remains so today. As that literature expanded, the view of tax competition changed, from wasteful and damaging to efficiency-enhancing. Such assessments of tax competition result from examining different aspects and employing different assumptions in theoretical and empirical models and can be controversial.[90] The variety of possible approaches to tax competition makes it difficult to relate the model used here to more than a handful of the selected research contributions in the vast literature.

The goal of this chapter is to extend the municipal tax choice analysis developed in chapter 2 to a multi-jurisdictional environment. To do so, a second comparable municipality is added.[91] That is, another municipality with identical individuals, two private goods, a utility maximizing municipal government providing a public service and having similar tax options is added. In this setting, local tax choices are no longer exercised independently because a decision of one jurisdiction imposes externalities on the other, causing the latter to respond. To broaden the model, a number of new assumptions and alternatives are considered:

1) mobile business capital and immobile labour/households;

2) commercial property investment as a proxy for business capital;

3) business rent maximization;

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[90] For a review of tax competition models see Wilson (1999) and Kenyon (1997).
[91] Although the analysis assumes only two municipalities, the implications for larger numbers (e.g. metropolitan areas) typically follow.

4) strategic behaviour;

5) the approach to comparing tax systems.

These are discussed in the context of the modern tax competition literature.

3.1.1. Mobile Business Capital and Immobile Labour/Households

First, the economic factors may differ greatly in their ability to move from one jurisdiction to another in response to fiscal changes. The multi-jurisdictional theoretical models – e.g. Zodrow and Mieszkowski (1986), Petchey and Shapiro (2000), Brueckner and Saavedra (2001), Parry (2003), – unanimously assume capital and firms to be perfectly mobile in the medium or long term.[92] There is no such consistency in handling labour, represented by the municipal residents. Many tax competition studies favour assuming labour mobility (see, for example, Krelove (1993), Wilson (1995), Lee (2004), Kessler and Lülfesmann (2005)) or a combination of mobile and immobile citizens (see Petchey and Shapiro (2000)). Fernández (2001) investigates the effect of population mobility on the provision of public services and finds that, under distortionary taxes, it does not change the outcome in the case of symmetric jurisdictions. However, when municipal characteristics, such as size, individual preferences and wage income vary, population mobility tends to worsen the underprovision of the local services for a net exporter of capital. These conclusions are based on his treatment of residents' mobility as an on-going process.

Others treat households (residents) as relatively immobile. This perspective can result from the assumption that people's choice of their place of residence is a one-time event. Kessler and Lülfesmann (2005) examine how individuals sort themselves into

[92] Also, see the reviews of capital tax competition models in Wilson and Wildasin (2004) and Krogstrup (2002).

local jurisdictions according to their preferences and income. If tastes are substantially different, sorting is dominated by tastes. If income differences prevail, people sort into rich and poor communities.[93] The authors prove that such sorting equilibria exist whether or not people are allowed to relocate later on. Brueckner and Saavedra (2001) use the idea to argue that, after extensive preference-based sorting, residents may be viewed as immobile.[94] In their model with only property taxes, two municipalities and two types of utility functions, self-selection into homogeneous communities is assumed to deter further population mobility. Brueckner and Saavedra's preference-based pre-sorting assumption has two major advantages for our study of tax competition in this chapter: 1) it permits inclusion of several taxes without unnecessary complications and, more importantly, 2) it allows us to introduce restricted modes of population mobility – cross-border shopping and commuting – that are not inconsistent with pre-sorting and are sensitive to local fiscal policies. Making these assumptions narrows municipal interdependence to attracting and/or retaining capital within its borders.

3.1.2. Commercial Property Investment as a Proxy for Business Capital

With business capital the main mobile factor, a second issue emerges – that is, specifying the relevant concept for capital. Most local tax competition studies, including Petchey and Shapiro (2000), Fernández (2001), Parry (2003), Braid (2002), Fuest and Huber (2001), and Fredriksson, List and Millimet (2004), work with what Wilson (1999) calls "industrial capital" (or production investment). The definition does not seem appropriate in the municipal context as local governments commonly lack a well-defined

[93] In turn, Bartolome and Ross (2003) claim that, in addition to income sorting equilibria, there are income mixing equilibria. In their metropolitan area, suburb residents have to commute to work because all jobs are located in the city.

[94] The subsequent tax competition studies by Borck (2003) and Noiset (2003) also adopt population/labour immobility.

fiscal jurisdiction over such capital due to their limited geographic space and forms of taxation. To account for this aspect, Zodrow and Mieszkowski (1986) and Brueckner and Saavedra (2001), while persisting in the production oriented approach, redefine capital as "property investment" to make it, as a component of the property tax base, fiscally meaningful to a municipal government.

The empirical evidence prompts further clarification of the term "property investment" by distinguishing the types of business property. Ladd (1975) identifies two important classes of non-residential property in U.S. municipalities, industrial and commercial (retail). Each has different characteristics. Industrial property, involved in a production process, is, as a rule, unevenly distributed across municipalities. After analyzing Norwegian municipal data, Carlsen, Langset and Rattsø (2005) argue that, unless local manufacturing is dominated by low profit industries (e.g. paper and transport equipment), industrial capital is likely to enjoy fairly limited mobility. Another empirical study by Hawkins and Murray (2004) reveals that local industries do not seem to impact municipal sales tax revenues in any significant way because manufacturers avoid local sales taxes through tax-exempt inputs and exported final products.

In contrast, commercial (retail) investment is generally perceived as mobile because of its close affiliation with consumers, rather than with places. Wasser (2002) observes that retail firms in the metropolitan areas of the western USA follow their clients, particularly from the city centre to the suburbs where many residents chose to migrate. The importance of a consumer base suggests sensitivity of retail capital to most types of municipal taxes. Even if not affected directly by the tax itself, it may still be affected by the response of residents-consumers to taxation (e.g. an increase in residential property

tax may reduce people's spending on retail purchases). Furthermore, the retail sector is favoured over the industrial sector by most municipalities as they seek to attract environmentally friendly and low service demanding activities. Expected patronage from municipal governments along with its potentially higher mobility and tax sensitivity makes commercial property investment better suited for modeling strategic interactions in local taxes.

3.1.3. Business Rent Maximization

Most studies adopt a "neutral" style of capital taxation when each jurisdiction maximizes residential welfare/utility (e.g. Brueckner and Saavedra (2001), Kächelein (2003), Zodrow and Mieszkowski (1986), Braid (2005), Pogodzinski and Sjoquist (1993)), land value (e.g. Wilson (1995), Wilson (1997)) or own tax revenue (e.g. Krelove (1993), Flochel and Madies (2002)) subject to its budget with a distortionary tax on general capital or non-residential property. They end up predicting strong intermunicipal dependence, resulting in significant pressures for tax reduction. Only a limited number of the theoretical studies explore rent extraction possibilities. Rauscher (1998) uses rents from capital overtaxation to determine if a Leviathan local government chooses to decrease its tax rate on this mobile factor after its exposure to interjurisidctional competition. On the contrary, Noiset (2003) assumes monopoly power of a jurisdiction over a locally produced product to justify its rent collection and tax burden exporting.

The limited theoretical investigation of rent extraction by municipalities is surprising given the availability of supporting empirical evidence. Ladd (1975) points out the contributions of industrial and commercial property types towards the education services consumed exclusively by the residents in the Boston area. The same phenomenon is

present in the Ohio data examined by Spry (2003). He observes that the municipalities with access to rents from non-residential property oppose the adoption of the local income tax (and vice versa). According to Gerking and Morgan (1998), the considerable rents extracted by Wyoming municipalities from non-residential property generate and sustain wide property tax-expenditure mismatches there. Finally, Slack (2002) reports that municipal property tax reform in Ontario fails to promote equity for industrial and commercial properties, leaving them with a disproportionally higher tax burden.

The tax competition model of this chapter chooses to integrate business property overtaxation into the basic utility maximising design. With the property tax rates being differentiated, a local government is assumed to set its commercial property tax rate to maximise rents from this property type. Since each municipality continues to care about individual welfare, the taxation of its own citizens remains its focal priority. As a result, the municipal response to business capital flows becomes indirect: by adjusting residential property and other taxes, the government alters the retail conditions within its borders, and changes its business property tax rate and, in turn, the amount of rents. This not only conforms to empirical observations, but also makes rent extraction sustainable over time in a highly competitive environment.

3.1.4. Strategic Behaviour

The strategic nature of municipal interactions becomes obvious under the assumptions of fixed total capital stock and/or fixed total population in the region.[9] With factor scarcity, local governments exhibit complex interdependence, incorporating their neighbours' taxes into their own utility-maximising tax choices. That is where the behavioural elements of our model, best addressed by a game theory approach, begin to

[9] See Brueckner and Saavedra (2001), Edwards (2001), Fernandez (2001).

affect the outcome. A general review of game theory applied to the tax competition literature is found in Alfano and Salzano (1999). The authors discuss the importance of the following assumptions in explaining the observed patterns of competitive behaviour: 1) simultaneous (Cournot) versus sequential (Stakelberg) games; 2) one shot versus repeated games; 3) cooperative versus non-cooperative games.

The selection of the basic settings in the related theoretical studies is quite coherent. Yang (1999) is inclined to view each government as a Cournot player in relation to other governments. Flochel and Madies (2002) also agree that the same level governments are simultaneous movers and only a higher-level government can take a lead in taxation.[96] Both treat tax competition as a one-shot game. Their one-time utility or revenue maximization solution is sufficient to define steady municipal relationships, which are likely to remain so unless interrupted by direct external shocks (e.g. senior government tax regulations). In contrast, a repeated property tax competition game in Coates (1993) leads to property tax subsidies, something not normally observed in municipal fiscal arrangements.[97] Finally, the presence of numerous horizontal externalities is believed to discourage any municipal cooperation.

In agreement with the summarized theoretical studies, our research adopts a long-term perspective to convert local governments' responses into simultaneous adjustments. As well, higher governments are assumed away. Thus, we adopt a one-time non-cooperative model of municipal tax decisions.[98]

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[96] Bayindir-Upmann and Ziad (2005) prove that a weak Nash equilibrium always exists in a Cournot style competition of two governments.

[97] Municipal subsidies usually take the form of tax abatements or tax credits, both quite limited in the range of candidates, purposes and durability. Tax abatements in the Detriot area are studied by Anderson and Wassmer (1995) and tax credits in Winnipeg are examined by Cyrenne and Fenton (2000).

[98] Following Wildasin (1988) and Bayindir-Upmann and Ziad (2005), we also assume perfect information.

3.1.5. The Approach to Comparing Tax Systems

The theoretical studies evaluating the performance of different taxes in local competitive settings generally choose one of two approaches: 1) consecutive consideration of alternative single taxes and their relative performance on efficiency grounds or 2) simultaneous consideration of multiple taxes in a search for surviving candidates in equilibrium (or for the necessary conditions for their existence at the optimal/efficient level of public service provision).

The first approach has proven particularly useful for assessing the role of property taxes in local finances. Decomposing property into capital (housing structure) and land, Krelove (1993) demonstrates that a property tax is a distortionary tax on capital and a non-distortionary tax on land and, so, results in underprovision of government services. Haughwout (2001) investigates a potential move to only a property tax on land in New York City and finds it is non-optimal. Alternatively, Lee (2003) concludes that a uniform tax on both capital and land is the second best solution in his model.[99] Pogodzinski and Sjoquist (1993) compare municipal property and income taxes and determine that the property tax is superior if individual preferences are the same but incomes vary.[100]

The second approach is mainly aimed at determining what combinations of taxes can be sustained under municipal competitive interactions. The choice of optimality as a main criterion for such sustainability is commonly followed by the inclusion of a lump-sum tax or its equivalent – a residence-based wage tax under immobile population – as one of the available options. Under standard conditions, the presence of this lump-sum

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[99] Lee (2003) has absentee owners whose utility is ignored and property overtaxed in the local government maximization problem as they cannot vote in municipal elections. Their position is conceptually similar to business property owners in the present model.

[100] When Pogodzinski and Sjoquist (1993) assume all individuals to have identical preferences and incomes, property and income taxes are equally efficient (although not optimal).

tax has the potential to automatically guarantee the first best outcome, by dominating and, thus, eliminating distortionary taxes at the equilibrium (e.g. Braid (2000)). In contrast, any deviations from the standard underlying assumptions result in no support for lump-sum taxation superiority in the municipal competitive environment (e.g. Borck (2003), Braid (2005) and Wilson (1995)). These may include differences in capital endowments to individuals (Borck (2003)), foreign property ownership (Braid (2005)) and economies of scale in public production (Wilson (1995)). Wilson (1995) also shows that if people are allowed to move, the initially non-distortionary wage tax becomes distortionary, leading to public output underprovision.

Neither approach is actually suited for the purposes of our study, looking to compare diversified and non-diversified tax systems and then tax diversification options. A different evaluation strategy discussed below is developed and adopted instead.

3.1.6. This Study

In this chapter we seek insight into municipal tax choices in a competitive muli-jurisdictional environment. Besides property and sales taxes, appearing in chapter 2, payroll taxes are added to the set of options. Payroll taxes, that were non-distorting in the isolated municipality case under our assumptions, are distorting in the interactive environment. With no lump-sum tax equivalent in the competitive environment, the focus of tax diversification is centered solely on efficiency of public service provision. This situation suggests mixed comparisons of tax regimes, an approach not encountered in the reviewed studies. First, a property tax system diversified with either a sales tax or a payroll tax is compared with a property tax only system to determine if more efficient public provision can be achieved. Second, tax systems expanded with sales and payroll

taxes respectively are compared with each other for similar improvement in public service provision. Both exercises are repeated under cross-border shopping and commuting to see if the identified advantages of the diversified tax systems can survive these conditions.[101] The partial equilibrium technique is employed to complement this analysis, conducted for general functional forms (to allow for flexibility in the empirical application in the next chapter), with predictions of the most probable dynamics for the post-competitive municipal tax rates. For the first time, all effects are studied separately for two types of municipalities: receiving municipalities, whose tax bases are broadened by the inflow of foreign shoppers or by in-commuting, and supplying municipalities, whose tax bases are drained by the outflow of own shoppers or by out-commuting. By capturing more details behind the efficient municipal responses, the winner-loser classification of the interacting jurisdictions has potential to explain the existing patterns in the sales and income/payroll taxes that otherwise would require political economy or yardstick competition settings:[102] ready adoption of the second tax by some and its avoidance by others, and rate clustering around a specific value.

The key results of this chapter on the municipal tax choices of competing municipalities are the following: 1) a utility-maximizing local government favours property tax discrimination between property types (that is, overtaxation of business property) as a politically inexpensive way to reduce pressure on, and to improve wellbeing of, its own citizens-voters; 2) the extent of competitive distortions depends not only on the degree of capital mobility and individual preferences but also on the absence

[101] The absence of a sales tax in the tax choice literature naturally excludes cross-border shopping and the consequences from it. Common inclusion of a wage (or income) tax in municipal tax choices makes commuting a logical addition to these models. However, only three studies actually introduce commuting – Braid (2000 and 2002) by using spatial distances and Braid (2005) by assuming labour factor mobility.
[102] Representative studies are Hettich and Winer (1988) and Revelli (2002) respectively.

or presence of consumers' and workers' mobility; 3) a two tax system may be concluded to remain generally superior to a single tax one since in most competitive cases municipal governments manage to reduce the perceived marginal costs of public service provision through tax diversification; 4) the sales tax is predicted to be a better option for tax diversification in the absence of cross-border shopping and commuting due to an additional negative effect imposed by the payroll tax on the MWTP of local residents; 5) on the contrary, the payroll tax is predicted to be a better option in the presence of cross-border shopping and commuting given less uncertainty in strategic outcomes and less intense rate-reducing tax competition; 6) the model reveals the potential to reconcile contradictory empirical findings.

3.2. One Tax and One Publicly Provided Good under Capital Mobility

The purpose of this section is to initiate our examination of municipal tax choices under interjurisdictional competitive conditions. We begin with a simple situation having a single tax (a property tax) financing the provision of one publicly provided good with housing consumption fixed. Given these assumptions, the possibility of intermunicipal capital mobility is introduced. We then allow housing consumption to respond to property taxes and, subsequently, introduce separate property taxes on residential and business property.

3.2.1. Property Tax, Fixed Housing Consumption and Mobile Business Capital

Consider a region with two local jurisdictions and economies that constitute a part of a much larger national economy. The regional business capital, used for commercial property investment, earns the same rate of return $\bar{r}$ in both cities and moves freely between them. It is assumed that there is no capital in/outflow from the rest of the

economy (the short run perspective). The amount of capital in both municipalities adds up to its fixed total value, $K + K' = \overline{K}$, where K is the capital in the municipality itself and K' is the capital in the competing municipality. Capital can be expressed in per capita terms as $k = \frac{K}{N}$ and $k' = \frac{K'}{N'}$, where N and N' are populations in the given and neighbouring jurisdictions, respectively. Under the assumption that individuals sort according to their preferences, N and N' may be considered fixed and any remaining tax competition needs to be explained by interjurisdictional capital mobility. The assumption that capital does not enter or leave the region is an oversimplification as, in the long run, at least intermittent (if not continuous) capital movement into and out of the region would be expected. The capital rates of returns are equalized using $\bar{r}$ as the equalized rate (as it likely approximates the local equilibrium rates).

Letting the wage income w be exogenous implies a common regional (or even national) labour market, which later in this chapter is used to incorporate commuting to work by the individuals across the municipalities within the region. The private retail good is produced and supplied in any required quantity at a zero transportation cost from outside both municipal economies.[103] As a result, it is available at a single uniform cost of one to retailers everywhere in the region. Any differences in prices of the retail good to consumers are assumed to arise due to sales taxation. The mobility of capital, workers and goods seems representative of metropolitan environments and is expected to provide a realistic setting for studying the interdependence of local taxes.

With housing consumption assumed invariant, the individual's maximization of her utility function (separable in g) reduces to the choice of x when the budget constraint is

[103] The private retail good can be partially produced in the jurisdictions where it is consumed.

$w = (1+p)\bar{h} + x$. This makes private good consumption a function of the common property tax rate p: $x = x(p)$ (w is suppressed for simplicity), $x_p < 0$. Responding to x, the regional firms choose the amount of capital investment in commercial property in each city to maximize profits. Their profits per resident in the current jurisdiction (total profits divided by N) are expressed as the difference between their per capita revenue, $R(k, x(p))$, where $R_k, R_x > 0$ and $R_{kk} < 0$, and their per capita total cost, $C(k, x(p)) = \bar{r}k + \theta x(p) + pk$, where $\bar{r}$ is the national rate of return on capital and θ is the wholesale price of x, $\theta < 1$. The function $R(k, x(p))$ corresponds to the degree of the firms' presence (i.e. their capital investment) k in the municipality: no k implies no sales revenue; small k indicates small sales revenue; and larger k accompanies higher sales revenue to a certain limit. That is both variables k and x move together (rather than independently of each other), only revenue increases with x at a constant rate and with k at a decreasing rate. Thus, the choice variable of the retail firm is k. Differentiating $\pi = R(k, x(p)) - \bar{r}k - \theta x(p) - pk$ with respect to k yields $R_k(k, x(p)) - \bar{r} - p = 0$ or $k = k(p, x(p), \bar{r}) = k(p, \bar{r})$.[104] The use of k, instead of the total capital investment K, does not distort profit maximization as long as k remains proportional to K, i.e. N is kept constant.

The local government continues to maximize the indirect utility of the wage earning residents (provided the retail businesses are owned by a minority of the local residents and/or outsiders) subject to g being financed through the taxation of residential and

[104] If it is assumed instead that the retail sector gets x at a price of $1 - \varphi$ (where φ is a small number less than 1) and sells it at a price of 1, the profit maximization $R(k, x(p)) - \bar{r}k - (1 - \varphi)x(p) - pk$ with respect to k will not be affected.

business property. Business property taxes (pk) exceed the cost of public services to the business sector ($\bar{e}k$), so $(p-\bar{e})k > 0$ and the business sector subsidizes the residential sector. Thus, the maximization problem is $L = V(\bar{h}, p, g) + \mu[p\bar{h} + (p-\bar{e})k(p,\bar{r}) - g]$. The equilibrium MWTP, as estimated by the local officials, has to equal the new perceived marginal cost of g, $MWTP = PMC_g = \frac{\bar{h}}{\bar{h} + k + (p-\bar{e})k_p} = \frac{1}{1 + \frac{k}{\bar{h}}(1 + \varepsilon_p^k \frac{p-\bar{e}}{p})}$. This result reveals an increase in the PMC_g over its value of $\frac{1}{1+\frac{k}{\bar{h}}}$ in the case of the isolated municipality (when capital was fixed) due to business capital flight ($\varepsilon_p^k < 0$) from the jurisdiction in reaction to business property taxation. The negative reaction to the tax is reinforced through a direct inverse effect of the common property tax on x that is passed onto capital, $k_p + k_x x_p < 0$. Graphically, instead of the flat $PMC_g = \frac{1}{1+\frac{k}{\bar{h}}}$, the modified $PMC_g = \frac{1}{1 + \frac{k}{\bar{h}}(1 + \varepsilon_p^k \frac{p-\bar{e}}{p})}$ becomes an upward sloping function in g that reduces, or even eliminates, the overprovision of g due to the business subsidy in the isolated case. It is not obvious if the new equilibrium value of the MWTP remains below 1.

The extent of capital flight from the municipality (and, thus, the change in its PMC_g) will depend on the tax policy of its neighbour (p'). Ignoring any other potential mobility at this point (such as cross-border shopping and commuting), mutual fiscal dependence of the local jurisdictions results from the assumptions of equalized returns on business

property investment resulting from capital mobility, and limited capital availability in the region. Capital return equalization between the two jurisdictions may be expressed using the profit maximization first order conditions: $R_k(k, x(p)) - p = \bar{r} = R'_{k'}(k', x'(p')) - p'$. Along with the capital scarcity condition $kN + k'N' = \bar{K}$, it yields interdependence of per capita investments in business property in both municipalities, $k = k(p, p')$ and $k' = k'(p', p)$. Upon substituting the derived expression for k into the equilibrium condition $MWTP = PMC_g = \frac{\bar{h}}{h + k + (p - \bar{e})k_p}$, a reaction function of a general form $p = f(\bar{h}, k, \bar{e}, w) = f(\bar{h}, \bar{h}', p', \bar{e}, N, N', \bar{K}, w)$ can be obtained for the municipality in question, implying a relationship between the two property tax rates, or $\frac{\partial p}{\partial p'} \gtrless 0$. A similar reaction function exists for the neighbouring municipality.

The dynamics of the intermunicipal fiscal relationship can be predicted using simple analysis (without assuming any specific functional forms). The introduction of municipal interactions through business capital mobility has an adverse effect on residential utility maximization. The presence of the term $k_p < 0$ decreases the denominator of the PMC_g expression, making it more expensive for the local government to provide the same level of the public services. Because $k_p < 0$, the municipality will want to lower the property tax rate. Considering that the marginal subsidy from the business sector is positive, or $k + (p - \bar{e})k_p > 0$, the absolute amount of the subsidy can go up if the property tax cut

encourages sufficient inflow of business investment.[105] The other municipality will follow with its own decrease in the property tax rate. $\frac{\partial p}{\partial p'} > 0$ would be consistent with rate-reducing tax competition (downward adjustments in both property taxes compared with isolation) and a lower provision of g in equilibrium (see example 1 in Appendix 3.7).[106]

In this relatively simple case, the municipal government will make concessions to prevent or reduce business relocation. However, acting as competitors, the jurisdictions may stop short of eliminating business overtaxation.

3.2.2. Property Tax, Changing Housing Consumption and Mobile Business Capital

There is a major qualitative difference between the current and previous cases. Once h can be adjusted in response to the changes in p (the individual optimal choice is given by $\frac{U_h}{U_x} = 1 + p$), the negative x–p relationship is no longer imposed. Now the differences in individual preferences for h and x between the two jurisdictions become responsible for possible variation in the strength of municipal fiscal interactions.

The new expression for the equilibrium voters' MWTP acquires an additional negative term, ε_p^h, in the denominator,

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[105] This is the case here. Differentiating $k(p, p')N + k'(p, p')N' = \bar{K}$ with respect to p and solving for k'_p yields $k'_p = -k_p \frac{N'}{N}$. Since the capital response to its own tax is assumed to be negative ($k_p < 0$), $k'_p = -k_p \frac{N'}{N} > 0$.

[106] The term "tax mimicking" describes municipal relationships without specifying their origin such as tax rate competition, yardstick competition, expenditure spillovers, etc. The adoption of the utility maximizing framework, in which local governments compete for scarce resources by choosing taxes, narrows the potential interactions down to strictly tax rate competition.

$MWTP = PMC_g = \frac{h}{h + ph_p + k + (p - \bar{e})k_p} = \frac{1}{1 + \varepsilon_p^h + \frac{k}{h}(1 + \varepsilon_p^k \frac{p - \bar{e}}{p})}$. The resulting lower equilibrium provision of g is now caused not only by capital migration in response to larger p ($\varepsilon_p^k < 0$), but also by the erosion of the residential property tax base due to a decrease in housing consumption ($\varepsilon_p^h < 0$). Under the resulting municipal reaction function of $p = f(p', \bar{e}, N, N', \bar{K}, w)$, the relationship between both private consumption goods starts having some bearing on interjurisdictional interactions. If h and x are unrelated, so $x_p = 0$, capital flight is fuelled only by the direct effect of p on k. If h and x are substitutable, so $x_p > 0$, then an increase in the private good consumption provoked by the property taxation somewhat counterbalances its direct adverse effect on capital, making ε_p^k lower in absolute value (because of a greater business presence needed to meet the higher demand for x in the municipality). In the extreme case of h and x complementarity, so $x_p < 0$, the own tax effect on k is reinforced. Under the assumption that the overall tax impact on business property investment stays negative, $k_p + k_x x_p < 0$, rate-reducing tax competition ($\frac{\partial p'}{\partial p} > 0$) remains the most probable type of strategic behaviour and causes a decrease in the municipal PMC_g (see example 2 parts (a) and (b) in Appendix 3.7). In jurisdictions with $x_p > 0$ and $x'_{p'} > 0$, tax reductions are expected to be lower and overall tax competition between the jurisdictions weaker than in jurisdictions that face housing and retail good complementarity.

The newly derived condition for the PMC_g in its general form does not contain enough information to conclude how close it is to its first best value of 1. Depending on

a combination of economic factors, including residential and commercial property sensitivities to the property taxes, the local government may continue to under- or overprovide public services to local voters as well as lose some amount in possible rents extractable from the businesses within the jurisdiction.

3.2.3. Two Types of Property Taxes, Changing Housing Consumption and Mobile Business Capital

It may be in the local government's interest to separate residential and business property tax bases to facilitate different treatment of them. To ensure its political stability, the municipal leadership wants to choose the residential property tax rate, p, to maximize its voters' utility and would tend to secure the maximum possible tax shifting to the minority of business owners by charging a separate business property tax rate $\tilde{p}$ ($\tilde{p}-\bar{e}>0$). The observed practices of Canadian and US municipalities indicate the attractiveness of this strategy.

The introduction of the separate rate for business property does not change individual utility maximization, but does modify the profit maximization of the retail sector. The differentiation of $\pi = R(k, x(p)) - \bar{r}k - \theta x(p) - \tilde{p}k$ with respect to k now yields $R_k(k, x(p)) - \bar{r} - \tilde{p} = 0$ and $k = k(\tilde{p}, p, \bar{r})$. The own tax effect on business property investment is expected to remain negative ($k_{\tilde{p}} < 0$), whereas the residential tax effect can go either way depending on the relationship between h and x in the local economy (since $k_x > 0$, the sign of $k_p = k_x x_p$ depends on $x_p \gtrless 0$).

The government's calculation of the equilibrium provision of residential public services under the altered budget constraint, $ph(p) + (\tilde{p} - \bar{e})k(\tilde{p}, p, \bar{r}) = g$, results in

$MWTP = PMC_g = \frac{h}{h + ph_p + (\bar{p}-\bar{c})k_p} = \frac{1}{1 + \varepsilon_p^k + \varepsilon_{\bar{p}}^k \frac{(\bar{p}-\bar{c})k}{ph}}$. A parallel policy of rent extraction suggests setting $\bar{p}$ to maximize the transfer to the residential sector, $(\bar{p}-\bar{c})k(\bar{p},p,\bar{r})$. This requires $k + (\bar{p}-\bar{c})k_{\bar{p}} = 0$ which can be transformed into an expression equivalent to the rule of pricing with market power, $-\frac{1}{\varepsilon_{\bar{p}}^k} = \frac{\bar{p}-\bar{c}}{\bar{p}}$. Then the amount of rents to be extracted by the municipality will be inversely proportional to the own tax elasticity of capital. If the consumption goods are related, such tax base differentiation effectively links both local tax rates together, adding to the fiscal complexity. Totally differentiating $k + (\bar{p}-\bar{c})k_{\bar{p}} = 0$ once again, and assuming $k_{pp}.k_{pp} = 0$ for simplicity, yields $k_{\bar{p}}d\bar{p} + k_p dp + d\bar{p}k_{\bar{p}} = 0$ or $\frac{\partial \bar{p}}{\partial p} = -\frac{k_p}{2k_{\bar{p}}}$. The policy implications for municipal behaviour are: first, if $k_p > 0$ (meaning h and x are substitutes), $\frac{\partial \bar{p}}{\partial p} > 0$ and an increase in the business property tax has to accompany any increase in the residential property tax; second, if $k_p = 0$ (meaning there is no relationship between h and x), both p and $\bar{p}$ change independently; third, if $k_p < 0$ (meaning h and x are complements), $\frac{\partial \bar{p}}{\partial p} < 0$ and a decrease in $\bar{p}$ would be needed for any increase in p.[107] Substituting $-\frac{1}{\varepsilon_{\bar{p}}^k} = \frac{\bar{p}-\bar{c}}{\bar{p}}$ into the expression for the equilibrium

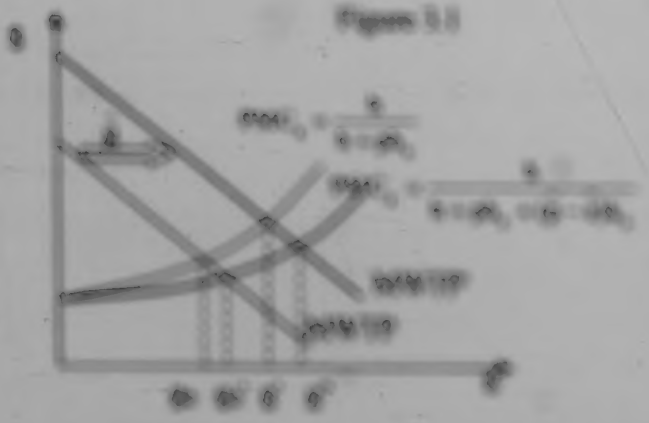
[107] Brueckner and Saavedra (2001) illustrate the case of the Boston metropolitan area, which prior to the

public provision yields $\partial V/\partial T + \partial NE'_0 = \frac{1}{1+\epsilon_T^V + \epsilon_T^{NE'_0}\frac{\partial NE'_0}{\partial g}} = \frac{1}{1+\epsilon_T^V - \frac{\epsilon_T^{NE'_0}}{\epsilon_g^{NE'_0}}\frac{\partial NE'_0}{\partial g}}$

Although a combination of both property taxes determines g_0, their contributions are different: the effects of the residential property tax (including $k_0 = 1$) become part of the supply side of the public output, changing the $\partial NE'_0$, whereas a major effect of the business property tax is on the demand side of the public output, boosting the voters' $\partial V/\partial T$ through the subsidy from business.

The subsequent analysis of the zero equilibrium is dominated by the above-discussed relationship between the two types of property taxes. The absence of g in the per capita investment function ($\delta_g = 0$) would mean $\partial V/\partial T + \partial NE'_0 = \frac{1}{1+\epsilon_T^{NE'_0}}$. The presence of business capital, despite mobility, imparts the voters as a lump sum subsidy of $\bar{\phi} = (\bar{p} - c)\bar{k}$ to local voters (i.e. the change from $\partial V/\partial T$ to $\partial V/\partial T'$ in Figure 5.1), resulting in higher public provision of services (g_0 to g'_0 in evidence). Under a positive relationship between k and g, the marginal cost becomes $\partial NE'_0 = \frac{1}{1+\epsilon_T^{NE'_0}\frac{\partial NE'_0}{\partial g}}$ and

Figure 5.1



restriction to residential property tax rate (Proposition 1(i)) comes in (5.1) and (5.2) simultaneously, as $\frac{\partial \bar{\phi}}{\partial \tau} = \bar{k}$, and after this restriction holds, consistent with an interiority solution ($\tau_0 > 0$), as $\frac{\partial \bar{\phi}}{\partial \tau} > 0$.

is lowered due to a favourable effect of residential property taxation on businesses through an increase in their sales revenue from x ($PMC_g = \frac{h}{h + ph_p + (\tilde{p} - \bar{e})k_p} < PMC_g = \frac{h}{h + ph_p}$ in Figure 3.1), whereas the MWTP shifts outwards due to $\tilde{g} = (\tilde{p} - \bar{e})k$ being provided free of charge to residents. For simplicity of comparison, it is assumed to shift to the same MWTP', implying the equilibrium provision g" in Figure 3.1.[108] In either case, there is an increase in the equilibrium provision of residential services (both g' and g" are greater than g_0 and g_0') accompanied by an increase in the voters' utility. By how much the total quantity supplied at the equilibrium (and, thus, utility) will go up depends on a combination of the factors involved: the size of each municipal tax rate and tax base, $\tilde{p}k$ and ph, and the tax sensitivity of business capital, $\varepsilon_{\tilde{p}}^{k}$ and ε_{p}^{k}. The change in public services to residents (resulting from the changes in PMC_g and MWTP) may lead to a level of g that exceeds the social optimum level at $MWTP = MSC_g = 1$.

A negative relationship between k and p implies lower effectiveness of business rents at subsidizing local residents. Although the subsidy from business tax still augments the voter's MWTP, the perceived marginal cost of g also goes up due to $k_p < 0$ ($PMC_g = \frac{h}{h + ph_p + (\tilde{p} - \bar{e})k_p} > PMC_g = \frac{h}{h + ph_p}$). As a result, the equilibrium provision of public services may increase, decrease or remain unchanged, depending on the magnitudes of both changes. Such uncertainty in the outcome of business property

[108] In the case of $k_p > 0$, the shift in the MWTP curve may not be strictly parallel.

overtaxation may make its practice less appealing to municipal governments, although the empirical evidence suggests it is used in the USA and Canada.

It is interesting to explore the $k_p > 0$ case further. Capital return equalization, $R_k(k, x(p)) - \tilde{p} = \bar{r} = R'_{k'}(k', x'(p')) - \tilde{p}'$, and capital scarcity, $kN + k'N' = \overline{K}$, jointly define per capita investment in both municipalities as functions of all existing tax rates, $k = k(\tilde{p}, p, \tilde{p}', p')$ and $k' = k'(\tilde{p}', p', \tilde{p}, p)$. The reaction function of each local jurisdiction, derived from the condition $MWTP = PMC_g$, has a general form of $p = f(p', \tilde{p}, \tilde{p}', \bar{e}, N, N', \overline{K}, w)$. This function specifies the municipal government's response to its neighbour's fiscal policy and its choice of residential and business property taxes to ensure the highest possible level of individual well-being. The model defines municipal relations qualitatively differently from similar theoretical studies: while tax interdependence (tax competition) between jurisdictions exists, no considerable reduction in residential property taxes is predicted compared to the case of tax choices in isolation. Any changes in business property taxes become second round effects (only as long as a change in p affects the consumption of x and a part of its effect is passed onto k). Such secondary relationships between municipalities' business property taxes, when analyzed empirically, are not likely to provide evidence of strong rate-reducing competition, down to $\tilde{p} = \bar{e}$, for retail capital.[109]

The preferences of local residents play an important part in determining the dynamics of the municipal interactions. If the individuals in both jurisdictions consider housing

[109]The empirical study by Brett and Pinkse (2000) finds evidence of positive tax interactions in municipal business property taxes in British Columbia, Canada, but casts doubts about this pointing to fierce tax competition for business capital.

and the private good substitutable ($k_p > 0, \frac{\partial \tilde{p}}{\partial p} > 0$ and $k'_{p'} > 0$, $\frac{\partial \tilde{p}'}{\partial p'} > 0$), $k_{p'} < 0$ and $k'_p < 0$ can be derived from the capital scarcity condition. Then, when employing small increases in p, the municipal authorities have no effect on their voters' utility through the effect on consumption goods since h and x are optimally chosen and $\frac{\partial V}{\partial h} = \frac{\partial V}{\partial x} = 0$. But raising p ensures a positive effect on k and removes the need for a business property tax ($\tilde{p}$) reduction to attract and/or retain capital.[110] If h' and x' are substitutable for the citizens in the other municipality, their government will follow the increase in p by raising its own p' for similar reasons. The resulting behaviour, also consistent with $\frac{\partial p'}{\partial p} > 0$, would be better described as rate-increasing tax competition (when both taxes are adjusted upwards compared with isolation). Qualitatively, this implies a greater downward shift in the perceived marginal cost curve than in the case of unrelated h and x, larger rents from the commercial sector and, thus, a higher equilibrium level of the public service provision.

Another interesting case, fitting some less common empirical findings, includes individual preferences that generate unrelated demands for housing and private good.[111] Because $x_p = 0$, $k_p = k_x x_p = 0$ and $\frac{\partial \tilde{p}}{\partial p} = 0$, the municipal reaction function $MWTP = PMC_g = \frac{h}{h + ph_p}$ does not have any k component and so is insensitive to the property tax rate of the neighbouring jurisdiction. If the municipalities are symmetric,

[110] Since k is expected to be highly responsive to changes in x and x changes with p (assuming h and x are related), the resulting effect of p on k may not be great but it is not zero.
[111] This absence of a relationship would follow from a Cobb-Douglas utility function, for example.

they behave as if they were in isolation when setting the residential property tax. However, both are expected to respond to capital mobility through the rent maximization condition $k+(\tilde{p}-\bar{e})k_{\tilde{p}}=0$. As it is chosen to maximize $(\tilde{p}-\bar{e})k(\tilde{p},\tilde{p}')$, any small reduction in $\tilde{p}$ has a negligible effect on the amount of rent from existing businesses in the jurisdiction. However, because it attracts more business capital to the municipality, this type of tax reduction constitutes a strategic move toward increasing the absolute amount of the residential subsidy. Thinking the same way, the other municipality is likely to go ahead with its own decrease in $\tilde{p}$ (see example 2 part (c) in Appendix 3.7). This scenario may explain the absence of any interactions in residential property taxes and the presence of positive interdependence in business property taxes for the British Columbian (Canada) municipal data used by Brett and Pinkse (1997).

The last type of individual preferences involves housing and private good complementarity. In this case, $x_p<0$, $k_p=k_x x_p<0$ and $\frac{\partial\tilde{p}}{\partial p}<0$, and $PMC_g=\frac{h}{h+ph_p+(\tilde{p}-\bar{e})k_p}$ is increased by residential property taxation. If the neighbouring jurisdiction experiences the same increase in its PMC_g due to similar voters' preferences, the only way the municipalities would interact in these settings is by reducing both residential property and business property taxes (rate-reducing tax competition). Any other asymmetric combination of preferences, when h and x are substitutable in one municipality but complementary in the other, are likely to produce other tax rate dynamics and harder-to-predict outcomes. Among other things, it could lead to a different dimension of the municipal interactions that incorporate indirect

(hidden) fiscal measures such as tax breaks and deductions, tax exemptions etc., which are not studied here.

Table 3.1 summarizes the major results from this section where we have a property tax and mobile business capital. The inclusion of a source of a politically valuable subsidy embodied in business property with low demands for public services helps explain common empirical findings for municipalities. Both rate-reducing and rate-increasing tax competition may occur. With a single property tax, the municipal reaction function given by the maximization of individual utility reflects a negative effect of business capital flight on public output provision. Because the government's choice of p is primarily determined by individual preferences, it involves only some tax burden shifting, $k+(p-\bar{e})k_p > 0$. The outcome depends on the degree to which local voters are willing to impose a property tax burden on themselves and the process of tax competition. When separate residential and business property taxes can exist, municipal decision making and interactions become more complex. By separating the property tax bases, the municipal government intends to reduce the tax distortion on local residents (reflected in the PMC_g) and to maximize rent extraction from local businesses (reflected in an outward shift of the MWTP curve).[112] Depending on the response of private good consumption (x) and business capital (k) to residential property tax changes ($\gtreqless 0$), municipalities may even find (when $x_p > 0$ and $k_p > 0$) that it is advantageous to have a higher property tax in a competitive environment.

[112] Two separate property tax rates are more likely to result in a more efficient transfer/subsidy compared with just one common property tax rate. However, there may be serious equity concerns if the per capita business tax base varies widely among municipalities.

Table 3.1: Summary of Municipal Interactions in Property Taxes

	Conditions	**Reaction function**	**Expected dynamics of interactions**	**Details**
Single property tax p	$x_p \gtrless 0$ $k_p < 0$	$p = f(p', \bar{e}, N, N', \bar{K}, w)$	Rate-reducing tax competition in the property tax.	Given the own negative tax effect on k, a reduction of p is used to retain retail businesses.
Two property taxes: residential p business $\tilde{p}$	$x_p > 0$ $k_p > 0$	$p = f(p', \tilde{p}, \tilde{p}', \bar{e}, N, N', \bar{K}, w)$	Rate-increasing tax competition in residential property taxes.	Given $k_p > 0$, an increase in p is used to attract/retain retail businesses.
	$x_p = 0$ $k_p = 0$	$p = f(w)$	No interactions in residential property taxes. Rate-reducing tax competition in business property taxes.	Given $k_p = 0$, a reduction in $\tilde{p}$ is used to attract/retain retail businesses.
	$x_p < 0$ $k_p < 0$	$p = f(p', \tilde{p}, \tilde{p}', \bar{e}, N, N', \bar{K}, w)$	Rate-reducing tax competition in residential property taxes.	Given $k_p < 0$, a reduction in p is used to attract/retain retail businesses.

3.3. Two Taxes and One Publicly Provided Good with Cross-Border Shopping

The response of housing consumption to property taxation made tax diversification attractive in the case of an isolated municipality. Then a sales tax was introduced. With interjurisdictional competition, adoption of a municipal sales tax may have limited benefits because of the induced negative responses – notably, the potential for a smaller commercial sector because residents choose to cross-border shop and non-residents decide to shop at home or elsewhere to avoid the tax. The analysis in this section examines the implications of introducing a sales tax (in addition to an existing property tax) in a multi-jurisdictional environment. Here we extend the model already developed. The property tax consists of separate residential and business property taxes. Housing is

responsive to property taxes. Capital is mobile and, now, for the purpose of shopping for the private consumption good, residents are also mobile (that is, they can cross-border shop). A sales tax is introduced into this situation.

3.3.1. Property and Sales Taxes, Changing Housing Consumption and Mobile Business Capital without Cross-Border Shopping[113]

Initially consider the case before cross-border shopping is possible. The introduction of the sales tax by the municipal government affects individual consumption. With both housing and the other private good now taxed, their optimal quantities are chosen according to $\frac{U_h}{U_x} = \frac{1+p}{1+s}$. If utility is assumed separable in g, this optimal consumption rule and the personal budget constraint allow us to solve for the individual demands $h^* = h^*(p,s)$ and $x^* = x^*(p,s)$ as well as the indirect utility function $V(h^*(p,s), x^*(p,s), g) = V(p,s,g)$.

In the simple case with shopping activities strictly confined to take place within municipal borders, the direct effect of the local sales tax on local businesses can be traced through their profit maximization condition. Differentiating $R(k, x(p,s)) - \bar{r}k - \theta x(p,s) - \tilde{p}k$ with respect to property investment yields $k = k(\tilde{p}, p, s, \bar{r})$. Since $k_x > 0$ and $x_s < 0$, then $k_s = k_x x_s$ must be negative and the commercial sector in the municipality is adversely affected by the taxation of retail purchases.

The new indirect utility function along with the modified balanced budget constraint, $ph(p,s) + sx(p,s) + (\tilde{p} - \bar{e})k(\tilde{p}, p, s, \bar{r}) = g$, implies new equilibrium conditions governing

[113] Housing is not subject to the sales tax.

municipal fiscal strategies. They are $MWTP = PMC_{g(p)} = \frac{h}{h + ph_p + sx_p + (\tilde{p} - \bar{e})k_p}$ and $MWTP = PMC_{g(s)} = \frac{x}{ph_s + x + sx_s + (\tilde{p} - \bar{e})k_s}$. Both perceived marginal cost components are added horizontally to obtain the total PMC of the per capita residential public service. Thus, its equilibrium provision is determined by $MWTP = PMC_{g(p)} = PMC_{g(s)}$ or where the MWPT crosses the total PMC_g. As mentioned in the previous chapter, the total PMC_g remains well defined as the horizontal summation of $PMC_{g(p)}$ and $PMC_{g(s)}$ when $h_s = x_p = 0$ and becomes more illustrative of the model otherwise. Adjustments in the total PMC_g depend on the relationship of the consumption goods in the local economy. If $x_p > 0$ and, thus, $k_p > 0$, the $PMC_{g(p)}$ and $PMC_{g(s)}$ curves are placed further apart than in the similar case in isolation[114] ($PMC_{g(p)}$ rotates rightwards due to $(\tilde{p} - \bar{e})k_p > 0$ and $PMC_{g(s)}$ rotates leftwards due to $(\tilde{p} - \bar{e})k_s < 0$), rendering the change in PMC_g and the corresponding change in g uncertain. If $x_p = 0$ and $k_p = 0$, only $PMC_{g(s)}$ is rotated to the left (because $(\tilde{p} - \bar{e})k_s < 0$), increasing the overall PMC_g and making public provision socially more expensive (thus, decreasing its quantity before the subsidy). Finally, if $x_p < 0$ and $k_p < 0$, both curves rotate leftwards (as both $(\tilde{p} - \bar{e})k_p < 0$ and $(\tilde{p} - \bar{e})k_s < 0$), unambiguously implying even a greater rise in the total PMC_g and a larger decline in the

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[114] In isolation, $PMC_{g(p)} = \frac{h}{h + ph_p + sx_p}$ and $PMC_{g(s)} = \frac{x}{ph_s + x + sx_s}$.

provision of the public service paid for by the residents themselves. Adjustments in the MWTP depend on the rents from the commercial sector: the more that is extracted in rents, the greater is the expansion of the residential public service, as the rents shift the MWTP curve outward at the expense of business. By maximizing rents, the local government reinforces interdependence among all municipal tax rates. The second derivative of $k+(\tilde{p}-\bar{e})k_{\tilde{p}}=0$, under the assumptions of $k_{\tilde{p}\tilde{p}}=0$, $k_{\tilde{p}p}=0$ and $k_{\tilde{p}s}=0$, is $2k_{\tilde{p}}d\tilde{p}+k_p dp+k_s ds=0$ implying $\frac{\partial\tilde{p}}{\partial p}=-\frac{k_p}{2k_{\tilde{p}}}$ (positive for substitutable h and x and negative for complementary ones) and $\frac{\partial\tilde{p}}{\partial s}=-\frac{k_s}{2k_{\tilde{p}}}$ (always negative). Any increase in $\tilde{p}$ calls for adjustment in other taxes as well – a decrease in s and either an increase (if $x_p>0$) or a decrease (if $x_p<0$) in p.[115]

The conditions of return equalization on commercial property investment ensure capital sensitivity to taxes in its own and in the neighbouring jurisdiction. Now even in the case of unrelated x and h, the residential property tax becomes responsive to the neighbours' taxes to the extent to which the equilibrium condition $PMC_{g(p)}=PMC_{g(s)}$ has to be maintained after competitive adjustments in s and $\tilde{p}$. With mobile business capital being the link between the interacting governments, the reaction functions for the sales taxes $s=j(s',p,\tilde{p},p',\tilde{p}',\bar{e},N,N',\bar{K},w)$, corresponding to the optimal sales tax selection $MWTP=PMC_{g(s)}=\frac{x}{ph_s+x+sx_s+(\tilde{p}-\bar{e})k_s}$ in the municipality in question, and $s'=j'(s,p',\tilde{p}',p,\tilde{p},\bar{e}',N,N',\bar{K},w)$, corresponding to its neighbour's choice under

[115] Thus, following the introduction of the sales tax, the business property tax is expected to decrease.

symmetric preferences, suggests rate-reducing tax competition. A small decrease in s produces hardly any effect on the utility level since, by the envelope theorem, the impact of taxation on the optimally chosen quantities of the consumption goods is minimal. However, this reduction may be sufficient to attract business capital (not optimized with respect to s) from across the border. Capital inflow is accompanied by increases in $\tilde{p}$ and the amount of rents, public output and, through it, the voters' utility.[116] To avoid losing businesses to its neighbour, the other municipality is expected to reduce its own sales tax rate. Only in the extreme case will this municipality choose to give up its sales tax – e.g. if it proves a costly way to fund the residential public services and/or contributes very little to the provision of g. At the same time, fiscal interactions in property taxes, resulting from $\mathrm{MWTP} = \mathrm{PMC}_{g(p)} = \dfrac{h}{h + ph_p + sx_p + (\tilde{p} - \bar{e})k_p}$, remain contingent on individual tastes ($k_p \gtrless 0$) and may not lead to downward competition in their rates. As was discussed earlier, rate-reducing tax competition is only expected under housing and private good complementarity whereas rate-increasing tax competition is expected under housing and private good substitutability.[117]

The position of the property tax in municipal finances cannot be seen as diminishing with tax base diversification. While the municipalities are always compelled to reduce their sales taxes due to competition for retail capital, they either increase, leave unchanged or decrease their residential property taxes (with the negative cross-tax effect

[116] Because the sales and residential property taxes are strategic variables for the utility maximizing municipality, the latter adjusts its business property tax to match the changes in the above, rather than directly in response to the capital movements.

[117] See the three possible cases considered at the end of the previous section of this chapter.

on x and, through it, on k bringing downward tax rate adjustments of a smaller magnitude than the negative own tax effect).[118]

3.3.2. Property and Sales Taxes, Changing Housing Consumption and Mobile Business Capital with Cross-Border Shopping

The impact of sales taxation on the municipalities proves far more complex once the residents' responses to the differentials in the after-tax prices of the private good are taken into account. In the present settings, cross-border shopping activities originate from the differences in the individual preferences between the two jurisdictions, attributed to the prior sorting of residents. If the residents of one of the municipalities have a relatively lower demand for the private good, that jurisdiction is expected to acquire a "locational disadvantage" – attracting fewer retail businesses than its neighbour. Experiencing little positive agglomeration effects and possibly higher transportation costs, the municipality in question may need to increase its per capita rate of expenditure on the commercial sector, $\bar{e}$. A weaker potential for business property rents implies a heavier reliance on the residential property tax, reducing its base. As a consequence, such a municipality would be motivated to introduce a sales tax, not so much for economic efficiency, but because of a potential for sales tax exportation and by the related political considerations of realizing tax burden relief for local home owners. A relatively low sales tax rate is expected to attract foreign shoppers into the jurisdiction. The empirical studies of municipalities in South Carolina by Ulbrich (1996) and in Georgia by Zhao (2005) name these factors as major determinants of sales tax adoption.

[118] All strategic adjustments in residential property taxes come after their initial changes (probably, reductions or at least not increases) following the introduction of the sales tax.

The other jurisdiction with its larger commercial sector, resulting from higher individual demands for the private good, is expected to benefit from retail agglomeration and to spend less per capita on business related services. Its incentives for sales tax introduction are somewhat different. In addition to a more balanced distribution of the overall tax burden in its economy, this municipality can dip into abundant sales tax revenue. Because of its "locational advantage" – concentration of more retail businesses – it is likely to set a relatively higher sales tax rate.

In reality, cross-border shopping trends can go in two ways. First, the residents of the disadvantaged municipality may choose to shop across the border to enjoy a better-developed retail infrastructure (malls, transportation, etc.). Second, the residents of the more fortunate municipality may start traveling outside to take advantage of the lower sales tax in the neighbouring jurisdiction, prompting businesses to follow. The choice of the second scenario for the model below is based on the empirical evidence that profit-maximizing retail firms are driven out of cities by higher sales and commercial property taxes,[119] and that shoppers are sensitive to sales tax differences between jurisdictions.[120] Such a perspective places emphasis on strategic municipal interactions by incorporating the possibility that a disadvantaged jurisdiction might diminish or reverse its original "locational disadvantage" through municipal fiscal policies.

The theoretical presentation of consumers' mobility in this section follows two standard principles of the cross-border shopping literature. First, the after tax price differences encourage shoppers from the jurisdiction with a higher gross-of-tax price to take advantage of a lower gross-of-tax price in the neighbouring jurisdiction. Most

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[119] See Batik (1991) and Haughwout, et al. (2004).
[120] See Luna (2004).

studies allow for variation in both sales taxes and taxed commodity prices, e.g. Lucas (2004), Christiansen (1994) and Scharf (1999).[121] In this study, as in Nielsen (2001), consumers everywhere initially face the same net-of-tax price, so their shopping responses come down to comparing sales tax rates. Second, distances limit the residents' willingness to travel. In most works, such as Nielsen (2001), Ohsawa (1999), Christiansen (1994) and Scharf (1999), this idea is implemented through a transportation cost added to the expenditure on the across the border retail purchases. However, in the current set up, the impact of distance is only implied by modelling the number of cross-border shoppers as a fraction of the entire municipal population.

The subsequent analysis of cross-border shopping effects diverges from that of the above-mentioned studies because of methodological differences. There is no need for sales tax revenue maximization, like in Nielsen (2001) and Ohsawa (1999), since the municipalities in this model extract no rents from taxation of retail sales (only retail property). Instead, as in Christiansen (1994) and Lovely (1994), they remain concerned with citizens' utility maximization. However, a strict differentiation is made between the cases when cross-border shopping visibly boosts or hurts the local finances. If faced with an inflow of foreign shoppers, the municipality (from now on referred to as the "receiving municipality") is expected to use an increase in its sales tax revenue to alleviate the tax burden on its own taxpayers. Alternatively, if faced with an outflow of its own shoppers, the jurisdiction (now known as the "supplying municipality") is assumed to preserve its independent fiscal policy by maximizing the utility of its non-traveling residents and allowing for differences in individual utility levels based on

[121] These studies choose to model cross-border shopping without considering interjurisdictional municipal tax competition, making their results irrelevant for the present research.

differences in shopping mobility. In this way, the full impact of cross-border shopping can be examined, not only as it affects the choices of and interactions in sale taxes, but also on the choices of and interactions in other taxes. As a result, our model is more complex than those in the above theoretical works.

Receiving municipality. Assume that, as a result of the people's prior sorting, the municipality in question has a relatively low x and, in turn, chooses a lower utility maximizing sales tax rate than its neighbour, $s < s'$ (s' is the sales tax of that neighbour). This municipality may also count on receiving $\alpha(s,s')N'$ shoppers from across the border, where the fraction of N' who cross-border shop is assumed to be responsive to the tax differences between the two jurisdictions, $\alpha(s,s') = \alpha(s'-s)$, where α is a share of cross-border shopping population (mostly those near the border), $\alpha < 0.5$ and $\alpha' > 0$.[122] Such cross-border shoppers are assumed to do all the shopping. The receiving local government collects $s\alpha(s,s')\hat{x}'(p',s)\delta$ in additional per capita sales tax revenue, where $\hat{x}'(p',s)$ is the private good consumption of each non-resident shopper and $\delta = \frac{N'}{N}$ is the ratio of the populations in the two jurisdictions. The function $s\alpha(s,s')\hat{x}'(p',s)\delta$ is positive as long as $s < s'$ and approaches zero as s approaches s'.

The inflow of shoppers modifies the profit condition of local businesses $R(k, x(p,s) + \alpha(s,s')\hat{x}'(p',s)\delta) - \bar{r}k - \theta x(p,s) - \alpha(s,s')\theta\hat{x}'(p',s)\delta - \tilde{p}k$, which now reflects the greater per capita consumption of the private good in the receiving municipality. The subsequent business profit maximization, $R_k(k, x(p,s) + \alpha(s,s')\hat{x}'(p',s)\delta) - \bar{r} - \tilde{p} = 0$, implies responsiveness of the optimally chosen business capital $k = k(\tilde{p}, p, s, \bar{r}, p', s', \delta)$ to

[122] Cross-border shoppers are assumed to do all their shopping in the receiving municipality.

the own business property tax $\tilde{p}$ and the sales tax s as well as its possible sensitivity to the residential property tax p (if housing and private good consumption are related). Since $k_x > 0$ and $x_s < 0$, sales taxation forces a decrease in the commercial property investment, $k_s = k_x x_s < 0$. Now, however, with cross-border shopping, a reduction in k may not result from introducing a sales tax due to the additional purchases of x made by outsiders. In fact, if more x is sold under cross-border shopping, despite the sale tax, the municipality has become a better location for retail businesses. Such an advantage can be exploited by the municipal government to extract a larger per capita subsidy $(\tilde{p}-\bar{e})k(\tilde{p},p,s,\bar{r},p',s',\delta)$ for its own residents through its rent maximization policy, $\frac{\tilde{p}-\bar{e}}{\tilde{p}} = -\frac{1}{\varepsilon^{k}_{\tilde{p}}}$.[123]

The revenue, acquired by partially exporting the sales tax to non-residents, is used, along with the rents collected from business, for the public provision of municipal services, $ph(p,s)+sx(p,s)+(\tilde{p}-\bar{e})k(\tilde{p},p,s,\bar{r},p',s',\delta)+s\alpha(s,s')\hat{x}'(p',s)\delta = g$. Thus, maximization of individual utility, $V(p,s,g)$, subject to the altered budget constraint, yields the new equilibrium conditions $MWTP = PMC_{g(p)} = \frac{h}{h+ph_p+sx_p+(\tilde{p}-\bar{e})k_p}$ and

$$MWTP = PMC_{g(s)} = \frac{x}{ph_s+x+sx_s+(\tilde{p}-\bar{e})k_s+(\alpha\hat{x}'+s\alpha_s\hat{x}'+s\alpha\hat{x}'_s)\delta}.$$

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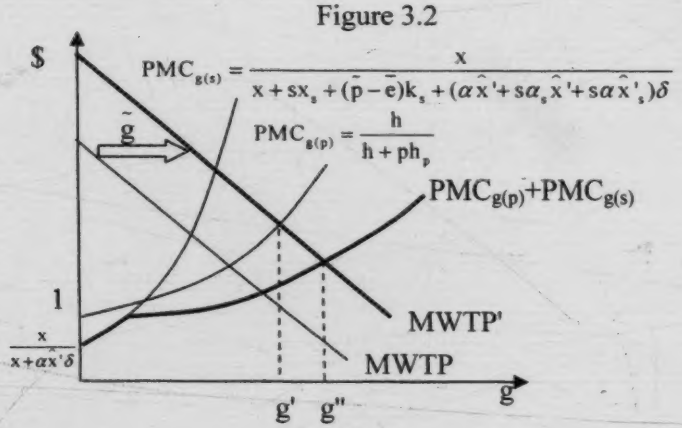
[123] Notice the difference with $(\tilde{p}-\bar{e})k(\tilde{p},p,s,\bar{r})$, the expression for the case without cross-border shopping. The newly derived $k(\tilde{p},p,s,\bar{r},p',s',\delta)$ becomes sensitive to both sales taxes. Now the own sales tax s influences k not only through the consumption of private good x, but also through cross-border shopping trips reflected in α. Rent maximization policy ensures that the cross-border shopping effect is built into the optimal value of $\tilde{p}$.

The first expression does not include any direct effect of cross-border shopping on the portion of the perceived marginal cost based on property taxation in the municipality. The only difference with the single tax system is captured by the presence of sx_p in the denominator (that is, of course, if the two consumption goods are related). This term along with $(\tilde{p}-\bar{e})k_p$ may account for somewhat higher (when $x_p<0$ and $k_p=k_x x_p<0$) or somewhat lower (when $x_p>0$ and $k_p=k_x x_p>0$) values of the $PMC_{g(p)}$ for similar levels of g, but qualitatively it remains the same upward sloping curve with the starting value of 1 (see Figure 3.2 where $PMC_{g(p)}$ corresponds to the case of no relationship between h and x, or $x_p=0$).

The second expression involving $PMC_{g(s)}$, on the contrary, incorporates the full marginal effect of cross-border shopping activities. Once the outsiders start shopping within the jurisdiction, it is a cost minimizing (and, thus, utility maximizing) strategy for the receiving municipality to keep $(\alpha\hat{x}'+s\alpha_s\hat{x}'+s\alpha\hat{x}'_s)\delta$ non-negative, implying $\alpha\hat{x}'(1+\varepsilon_s^{\alpha}+\varepsilon_s^{\hat{x}'})\delta\geq 0$ or $1+\varepsilon_s^{\alpha}+\varepsilon_s^{\hat{x}'}\geq 0$. In other words, if cross-border shopping results in ε_s^{α} and $\varepsilon_s^{\hat{x}'}$ sufficiently large, this jurisdiction can set its sales tax s so that it will partially or

Figure 3.2



completely offset a negative initial effect of the sales tax on capital investment, $(\tilde{p}-\bar{e})k_s < 0$.[124] Graphically, the municipality's ability to export part of the sales tax burden is reflected in the downward shift of the whole $PMC_{g(s)}$ schedule along with its possible rightward rotation when compared with the previous case of no cross-border shopping (again, when h and x are assumed to be mutually unrelated and $h_s = 0$). As a result, its starting value drops from 1 to some number $\frac{x}{x+\alpha\hat{x}'\delta} < 1$.

The absolute quantity of g is determined by the same equality of the MWTP (shifted to right by the business subsidy provision) and the total $PMC_g = PMC_{g(p)} + PMC_{g(s)}$. Both sides of this condition are positively affected by the inflow of shoppers from outside the municipal borders. Being a more attractive location for retail firms translates into a larger subsidy to the residential public services and, thus, together with the expanded sales tax base, into a greater outward shift of the MWTP curve (to MWTP' by $\tilde{g}$ in Figure 3.2). With the out-of-jurisdiction shoppers being a part of the local sales tax base, the overall PMC_g acquires a discontinuity: it coincides with the $PMC_{g(s)}$ between $\frac{x}{x+\alpha\hat{x}'\delta}$ and 1, and then is made of the horizontal summation of both $PMC_{g(p)}$ and $PMC_{g(s)}$ from 1 on. Although the equilibrium values of MWTP and total PMC_g are likely to remain greater than 1, the now higher MWTP and lower PMC_g curves secure an increase in the per capita amount of public services (from g' under only property taxation to g" under joint property and sales taxation in Figure 3.2). Moreover, this increase in g

[124] This seems to imply a locational advantage or local fiscal advantage that makes this municipality more attractive for businesses.

is accompanied by an even less reliance on the property tax by the local government. The optimal tax ratio derived from $PMC_{g(p)} = PMC_{g(s)}$ with the cross-border shopping activities, $\frac{p}{s} = \frac{xx_p - hx_s}{hh_s - xh_p - \frac{(\tilde{p} - \bar{e})(xk_p - hk_s)}{p} + \frac{h(\alpha\hat{x}' + s\alpha_s\hat{x}' + s\alpha\hat{x}'_s)\delta}{p}}$, is clearly less than the ratio without cross-border shopping, $\frac{p}{s} = \frac{xx_p - hx_s}{hh_s - xh_p - \frac{(\tilde{p} - \bar{e})(xk_p - hk_s)}{p}}$, for similar values of other variables, mitigating the tendency to set a larger property tax rate relative to the sales tax rate (induced by $k_s < 0$ and possibly $k_p > 0$).

The resulting decreases in the marginal costs and the noted tax burden redistribution between the property and sales taxes in the receiving municipality depend, among other factors, on the relative population size $\delta = \frac{N'}{N}$. The larger is the receiving jurisdiction compared with the supplying one, the fewer gains it can realize from the favourable cross-border shopping trend. As δ approaches zero, per capita tax exportation $s\alpha\hat{x}'$ also approaches zero. On the contrary, when the receiving municipality is relatively small in size, its retail related advantage is reinforced. This suggests a greater appeal of the sales taxes to smaller jurisdictions.[125] When municipalities are of equal size ($\delta = 1$), the receiver's benefits depend entirely on the preferences and degree of mobility of the foreign shoppers.

Supplying municipality. The advantages of cross-border shopping to the receiving municipality come at the expense of its neighbour. The supplying municipality is in the

[125] Ulbrich (1996) reports that, out of 60 cities with the local sales taxes in South Carolina in 1993-94, 28 were what he calls "tinytowns" (1,000 people or less) and 22 were "middletowns" (5-10,000 people). The same conclusion is also reached in the theoretical studies by Ohsawa (1999) and Lucas (2004).

opposite fiscal position and that is expected to affect its choice of competitive strategies. Facing distinct residential preferences supporting a higher optimal sales tax rate, its local government may find it more difficult to reduce its sales tax, but may be compelled to reduce or eliminate the outflow of shoppers. Its reaction function needs to be considered along with the function of the receiving municipally to understand the interactions between the two.

Ignoring the case of large differences in the marginal cost components of g in terms of the property tax and the sales tax, an optimally behaving supplying municipality generally prefers a two-tax system to a single tax one for the efficiency reasons discussed in the previous chapter. A partial erosion of its sales tax base due to cross-border shopping by its residents changes the situation for all local participants – businesses, residents and the government. Reduced sales of the private good affect the profits of the commercial sector, $R'(k',(1-\alpha(s,s'))x'(p',s')) - \bar{r}k' - (1-\alpha(s,s'))\theta x'(p',s') - \tilde{p}'k'$, possibly causing per capita property investment $k' = k'(\tilde{p}', p', s', \bar{r}, s)$ to decline.[126] The citizens-voters are impacted unevenly, based on their shopping mobility. If the residents continue to shop within their own jurisdiction, their utility maximization involves the choice of h' and x' according to $\frac{U'_{h'}}{U'_{x'}} = \frac{1+p'}{1+s'}$. If, instead, they choose to travel to the neighbouring municipality to take advantage of a lower sales tax, they adopt $\frac{U'_{h'}}{U'_{x'}} = \frac{1+p'}{1+s}$ for their optimal consumption rule, $\frac{1+p'}{1+s} > \frac{1+p'}{1+s'}$. Such a change in the consumption

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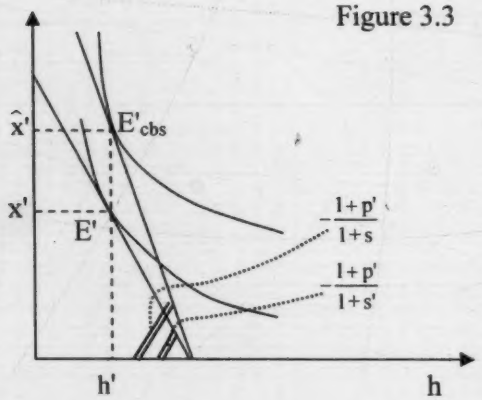
[126] Profit maximization $R'_{k'}(k',(1-\alpha)x'(p',s')) - \tilde{p}' = \bar{r}$ makes k' in the supplying municipality a function of slightly different variables (where $k'_{\alpha} < 0$, $\alpha_s < 0$ and $k'_s = k'_{\alpha}\alpha_s > 0$).

pattern of the traveling shoppers can be predicted to translate into their higher wellbeing in terms of the consumption good. How exactly it impacts the municipal government in their home jurisdiction depends on the relationship between housing and the private good given by individual preferences.[127]

Case One. First, consider *the case of housing and the private good being mutually unrelated*, i.e. $h'_{s'} = 0$ and $x'_{p'} = 0$.[128] Then the traveling residents, when facing a lower sales tax rate across the border, simply choose to buy more of the private good there and continue to consume the same amount of housing at home (see Figure 3.3 where E' is the equilibrium for the immobile consumers with choices of h' and x', and E'_{cbs} is the equilibrium for the mobile consumers with choices of h' and $\hat{x}'$, $\hat{x}' > x'$). The cross-border shopping trips cause a loss in utility for all local residents in the supplying municipality because of the resulting reduction in public services, $p'h'(p') + (1-\alpha(s,s'))s'x'(s') + (\tilde{p}' - \bar{e}')k'(\tilde{p}', s', \bar{r}, s) = g'$. The negative impact on g' is carried out through two channels: there is a partial erosion of the sales tax base and there is a decrease in business property investment, which is

Figure 3.3



[127] The locational advantage for retail businesses may result in $s > s'$ if the receiving municipality chooses to exploit its advantage by setting a higher sales tax. Such a possibility is not surprising because an increase in the business property tax $\tilde{p}$ is not always an alternative or is unattractive to the municipal government for other reasons.

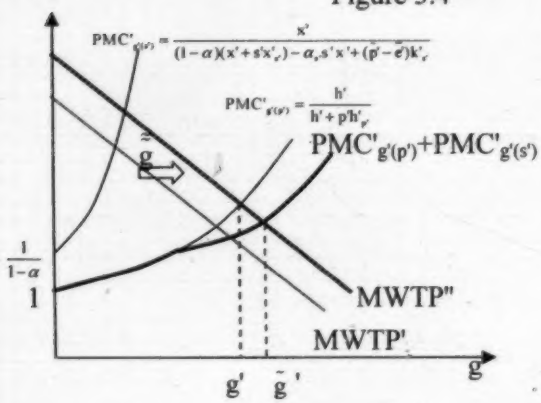
[128] $U = h^{\alpha}x^{\beta} + \ln g$ produces such separability in demands $h^{*} = \frac{w}{(1+\frac{\beta}{\alpha})(1+p)}$ and $x^{*} = \frac{\frac{\beta}{\alpha}w}{(1+\frac{\beta}{\alpha})(1+s)}$.

followed by a reduction in $\tilde{p}'$ and in the amount of rents. Increased shopping activities across the border are likely to make the jurisdiction in question less attractive to business and, therefore, retail businesses may move to the other municipality. Diminishing business presence will inevitably be accompanied by a reduction in the collected rents and, thus, the subsidy to the residential sector. Both factors work simultaneously and tend to reinforce one another, as leaving the jurisdiction to shop elsewhere encourages local businesses to follow, which, in turn, promotes cross-border shopping trips.

The subsequent government maximization of the indirect individual utility $V'(p',s',g')$ subject to the modified budget constraint given above yields new equilibrium conditions: $MWTP' = PMC'_{g'(p')} = \frac{h'}{h' + p'h'_{p'}}$ (since $k'_{p'} = k'_{x'}\, x'_{p'} = 0$) and $MWTP' = PMC'_{g'(s')} = \frac{x'}{(1-\alpha)(x' + s'x'_{s'}) - \alpha_{s'}s'x' + (\tilde{p}' - \bar{e}')k'_{s'}}$. Clearly, it is the $PMC'_{g'(s')}$ that incorporates the full marginal effect of the outflow of local consumers. Graphically, the $PMC'_{g'(s')}$ curve shifts upward with a starting value of $\frac{1}{1-\alpha}$ and rotates leftward due to the additional reduction in the denominator's value by $1-\alpha$ and $\alpha_{s'}s'x'$. As the $PMC'_{g'(p')}$ remains unchanged, the total $PMC'_{g'}$ becomes discontinuous, coinciding with $PMC'_{g'(p')}$ between the values of 1 and $\frac{1}{1-\alpha}$ and comprising the horizontal summation of both $PMC'_{g'(p')}$ and $PMC'_{g'(s')}$ from $\frac{1}{1-\alpha}$ onwards (see Figure 3.4). These changes along with the smaller net outward shift in the $MWTP'$ (due to lower per capita rents from the

local business sector and shrinkage of the sales tax base)[129] may imply a less significant increase in the public output (from g' under the property tax only to $\tilde{g}'$ under the property and sales taxes in Figure 3.4). This is the consequence of the supplying municipality's inability to distribute the tax burden evenly between the two tax bases. Thus, its heavier reliance on the residential property tax is preserved: using the equality of the perceived marginal cost components $\frac{h'}{h'+p'h'_{p'}} = \frac{x'}{(1-\alpha)(x'+s'x'_{s'})-\alpha_{s'}s'x'+(\tilde{p}'-\bar{e}')k'_{s'}}$, the new tax ratio $\frac{p'}{s'} = \frac{-(1-\alpha)h'x'_{s'}+h'\alpha_{s'}x'}{-x'h'_{p'}-\frac{\alpha h'x'}{p'}+\frac{h'(\tilde{p}'-\bar{e}')k'_{s'}}{p'}}$ is greater than the ratio $\frac{p'}{s'} = \frac{-h'x'_{s'}}{-x'h'_{p'}+\frac{h'(\tilde{p}'-\bar{e}')k'_{s'}}{p'}}$ without cross-border shopping since $h'\alpha_{s'}x' > 0$ and $\frac{\alpha h'x'}{p'} > 0$.

Figure 3.4



To determine the dynamics of municipal interactions in this case when housing and the private good demands are unrelated implies equilibrium conditions $MWTP = PMC_{g(p)} = \frac{h}{h+ph_p}$ and

[129] As before the rents from the business sector provide a subsidy to the provision of residential public services, shifting MWTP' to the right. At the same time the loss of some sales tax revenue to cross-border shopping reduces the residential public service provision, shifting MWTP' to the left. Assuming the magnitude of the rightward shift is greater than of the leftward shift, the net change in MWTP' is given by a smaller outward shift.

$$MWTP = PMC_{g(s)} = \frac{x}{x + sx_s + (\tilde{p} - \bar{e})k_s + (\alpha\hat{x}' + s\alpha_s\hat{x}' + s\alpha\hat{x}'_s)\delta}$$ as well as the general reaction functions (or unsolved FOCs) $p = f(p', s, \tilde{p}, s', \tilde{p}', \bar{e}, N, N', \overline{K}, w)$ and $s = j(s', p, \tilde{p}, p', \tilde{p}', \bar{e}, N, N', \overline{K}, w)$ for the receiving municipality. The fiscal strategies of the supplying municipality are $p' = f'(p, s', \tilde{p}', s, \tilde{p}, \bar{e}, N, N', \overline{K}, w)$ and $s' = j'(s, p', \tilde{p}', p, \tilde{p}, \bar{e}', N, N', \overline{K}, w)$. In this situation, only secondary competitive adjustments are expected in local residential property taxes. Such behaviour is empirically observed by Sjoquist, Walker and Wallace (2005) in some of the largest U.S. cities where newly introduced sales as well as income taxes are used to reduce the residential property taxes.[130] The municipalities are predicted to directly compete by reducing their business property taxes instead.

The municipal reaction functions for sales taxes have a different story to tell. It seems attractive for the receiving municipality to balance a positive cross-border shopping effect, $(\alpha\hat{x}' + s\alpha_s\hat{x}' + s\alpha\hat{x}'_s)\delta$, against a negative capital investment effect, $(\tilde{p} - \bar{e})k_s$.[131] Once both impacts are balanced, this jurisdiction will not want to change its sales tax rate. Alternatively, the supplying municipality has to figure out how to deal with the loss of its own shoppers and retail businesses. One of the supplier's possible strategies includes copying the sales tax rate of its neighbour. Keeping its sales tax at s' (before reacting to losing a fraction of its residents-consumers to cross-border shopping)

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[130] Given the unpopularity of property taxes in the United States, it is not uncommon for the municipalities there to reduce property taxes once sales taxes are adopted. This was the case for the Georgian municipalities studied by Zhao (2005).

[131] This is a similar idea to the one examined by Luna (2004): i.e. how local governments balance their desire for lower sales tax rates to encourage an inflow of cross-border shoppers with their desire to get more tax revenue from the retail activities.

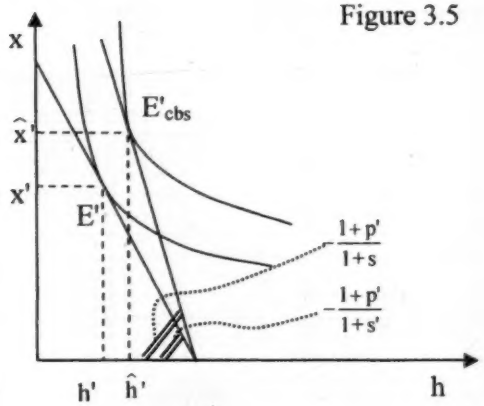
would imply $p'h'+(1-\alpha)s'x'+(\tilde{p}'-\bar{e}')k'=g'$ in public services, while decreasing its sales tax to $s'=s$ yields $p'h'+sx"+(\tilde{p}"-\bar{e}')k"=g"$, where $p'h'$ is assumed constant, $x"$ and $k"$ are new higher quantities of private good and business property investment. If $g">g'$ or $sx"+(\tilde{p}"-\bar{e}')k">(1-\alpha)s'x'+(\tilde{p}'-\bar{e}')k'$, the latter is an optimal strategy as it minimizes the individual utility loss (by preventing a further decline in the public output under cross-border shopping). Matching the receiving municipality's tax rate reduces the outflow of business capital and leads to greater extractable rents. With business property expansion in the jurisdiction, $\left|\varepsilon^{k'}_{\tilde{p}'}\right|>\left|\varepsilon^{k"}_{\tilde{p}"}\right|$ which, via $\frac{\tilde{p}'-\bar{e}'}{\tilde{p}'}=\frac{1}{\left|\varepsilon^{k'}_{\tilde{p}'}\right|}$ and $\frac{\tilde{p}"-\bar{e}'}{\tilde{p}"}=\frac{1}{\left|\varepsilon^{k"}_{\tilde{p}"}\right|}$, translates into $\tilde{p}">\tilde{p}'$ and, thus, into $(\tilde{p}"-\bar{e}')k">(\tilde{p}'-\bar{e}')k'$. Although $x">x'$, to ensure $sx">(1-\alpha)s'x'$, the following condition must hold $s\geqslant(1-\alpha)s'$ or $\alpha\geqslant\frac{s'-s}{s'}$. In other words, if α is fairly sensitive to the sales tax differences between the two jurisdictions, there are strong benefits from the local sales tax reduction to eliminate cross-border shopping. If so, the strategy causes $PMC'_{g'}$ to decline with the decrease in its $PMC'_{g'(s')}$ component and the amount of rents to go up along with the increased shopping volume within the jurisdiction, leading to expansion of the provision of the public service. Since it is a post-cross-border-shopping tax level that is being matched by the supplying municipality, both municipalities are likely to end up with fairly low rates.[132]

Lower sensitivity of α could result in a different strategy for the supplying municipality. If a reduction in the sales tax rate is followed by a decrease in the per

[132] Notice that the relative population size δ does not seem to matter for the supplying municipality.

capita sales tax revenue, $sx'' < (1-\alpha)s'x'$, only a smaller increase in the public service can be achieved. Then, instead of the sales tax copying policy, $s' = s$, it may be more utility enhancing to adopt a limited decrease in the sales tax rate, still keeping a reduced rate somewhat above s. In either case, further undercutting by the receiving municipality is highly unlikely as, at low sales taxes, x becomes more inelastic and would require a greater sales tax cut to achieve the same magnitudes of cross-border shopping and retail business concentration and so would bring in less in tax revenue. The data on Tennessee municipalities in the USA analyzed by Luna (2004) supports such a competitive development. In 1994, almost 80% of these municipalities with local optional sales taxes clustered together around a 2.25% rate.[133]

Figure 3.5



Case Two. Next, let's examine *the case of positively related housing and private good demand*, so $h'_{s'} > 0$, $x'_{p'} > 0$ and $k'_{p'} = k'_{x'} x'_{p'} > 0$ hold for the supplying municipality.[134] With these preferences, the traveling shoppers distribute the savings from cross-border shopping to augment their

[133] Percentage calculations are done based on Table 1 in Luna (2004). Out of 95 municipalities in 1994, 54 went with a 2.25% sales tax rate, 12 with 2% and 8 with 2.5%, making (54+12+8)/95×100%≈78% of all municipalities. Their behaviour has not really changed since the late 1980s.

[134] The utility function $U = (h^{\delta} + x^{\delta})^{\frac{1}{\delta}} + \ln g$, and the corresponding demands $h^{*} = \frac{(1+p)^{\frac{1}{\delta-1}} w}{(1+p)^{\frac{1}{\delta-1}} + (1+s)^{\frac{1}{\delta-1}}}$ and $x^{*} = \frac{(1+s)^{\frac{1}{\delta-1}} w}{(1+p)^{\frac{1}{\delta-1}} + (1+s)^{\frac{1}{\delta-1}}}$ yield such a cross tax relationship for any $\delta < 1$. Of course the δ here is not the population ratio.

demands for both goods. Compared with strictly local shoppers (at the equilibrium in point E' in Figure 3.5), they find themselves on a higher indifference curve (point E'_{cbs} in Figure 3.5), consuming greater amounts $\hat{x}'$ and $\hat{h}'$ ($\hat{x}' > x'$ and $\hat{h}' > h'$ in Figure 3.5). The difference in their choices modifies the provision of the municipal service to $(1-\alpha(s,s'))p'h'(p',s') + \alpha(s,s')p'\hat{h}'(p',s) + (1-\alpha(s,s'))s'x'(p',s') + (\tilde{p}'-\bar{e}')k'(\tilde{p}',p',s',\bar{r},s) = g'$, which reflects both the direct negative and positive effects of cross-border shopping. On one hand, the per capita sales tax base shrinks by $1-\alpha$. On the other hand, residential property tax revenue expands by $\alpha p'(\hat{h}'-h')$ in per capita terms.[135]

All the above changes are incorporated by the local government into its new reaction functions through the maximization of individual utility,

$$MWTP' = PMC'_{g'(p')} = \frac{h'}{(1-\alpha)(h'+p'h'_{p'}) + \alpha(\hat{h}'+p'\hat{h}'_{p'}) + (1-\alpha)s'x'_{p'} + (\tilde{p}'-\bar{e}')k'_{p'}} \quad \text{and}$$

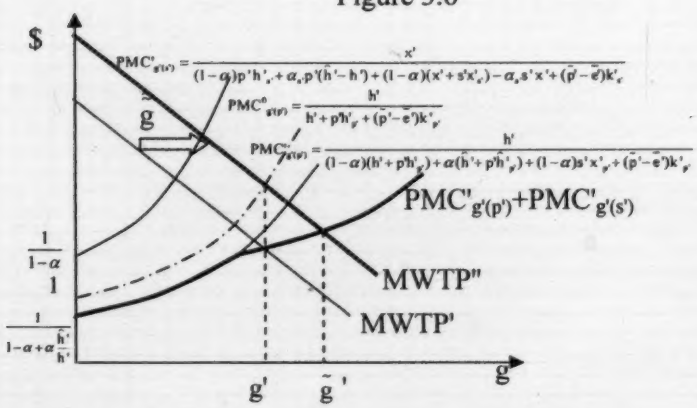
$$MWTP' = PMC'_{g'(s')} = \frac{x'}{(1-\alpha)p'h'_{s'} + \alpha_s p'(\hat{h}'-h') + (1-\alpha)(x'+s'x'_{s'}) - \alpha_s s'x' + (\tilde{p}'-\bar{e}')k'_{s'}}.$$

The influence of cross-border shopping becomes obvious in both components of the perceived marginal cost of the public output once compared with the equivalent conditions for the no cross-border shopping case. The $PMC'_{g'(p')}$ curve is adjusted downwards, acquiring a new lower starting value of $\frac{h'}{(1-\alpha)h'+\alpha\hat{h}'} = \frac{1}{1-\alpha+\alpha\frac{\hat{h}'}{h'}}$ (since

[135] Since $(1-\alpha)p'h' + \alpha p'\hat{h}' = p'h' - \alpha p'h' + \alpha p'\hat{h}' = p'h' + \alpha p'(\hat{h}'-h')$, the expected increase is given by $\alpha p'(\hat{h}'-h')$ with $\hat{h}' > h'$.

$\hat{h}' > h'$, $\frac{1}{1-\alpha+\alpha\frac{\hat{h}'}{h'}} < 1$ in Figure 3.6).[136] It also gets flatter, indicating an additional reduction in the $PMC'_{g'(p')}$ due to the accompanying positive marginal effect on private good consumption, $(1-\alpha)s'x'_{p'}$, and on business capital, $(\tilde{p}'-\bar{e}')k'_{p'}$. The $PMC'_{g'(s')}$ schedule shifts upwards, so it begins at $\frac{1}{1-\alpha}$, $\frac{1}{1-\alpha} > 1$, and experiences a more gradual increase over the same ranges of g, implied by the terms $(1-\alpha)p'h'_{s'}$ and $\alpha_{s'}p'(\hat{h}'-h')$ in its denominator. The total $PMC'_{g'}$ remains discontinuous as it perfectly overlaps with $PMC'_{g'(p')}$ between its values of $\frac{1}{1-\alpha+\alpha\frac{\hat{h}'}{h'}}$ and $\frac{1}{1-\alpha}$, and becomes the summation of $PMC'_{g'(p')}$ and $PMC'_{g'(s')}$ from $\frac{1}{1-\alpha}$ on (see $PMC'_{g'(p')}+PMC'_{g'(s')}$ in Figure 3.6). As a result, a smaller reduction in the provision of public services may be expected in the supplying municipality in this case than in the previous one. In comparison with the single property tax system, assuming $k'_{p'} > 0$ and an unchanged magnitude of

Figure 3.6



[136] By consuming more housing at any given property tax rate, the cross-border shoppers make its taxation in their municipality of residence (which is the supplying municipality) socially less expensive. Facing an increase in the local demand for housing, the utility maximizing government may raise the same amount in property tax revenue with a lower property tax rate.

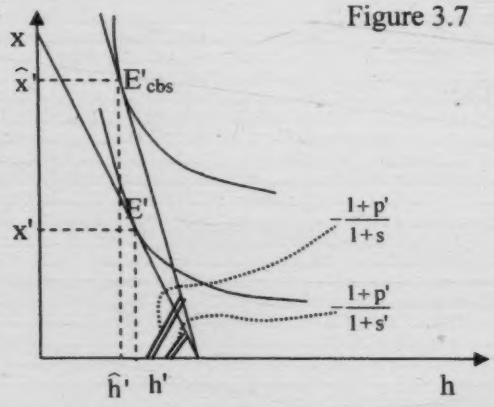
business rents, tax diversification brings an expected reduction in the overall perceived marginal cost of the public service and, thus, an increase in its provision to residents, $\tilde{g}'$ versus g' in Figure 3.6.

Assuming similar preferences for the receiving municipality, i.e. $MWTP = PMC_{g(p)} = \frac{h}{h + ph_p + sx_p + (\tilde{p} - \bar{e})k_p}$ and $MWTP = PMC_{g(s)} = \frac{x}{ph_s + x + sx_s + (\tilde{p} - \bar{e})k_s + (\alpha\hat{x}' + s\alpha_s\hat{x}' + s\alpha\hat{x}'_s)\delta}$, the general reaction functions show complex tax interdependence for both jurisdictions: $p' = f'(p, s', \tilde{p}', s, \tilde{p}, \bar{e}', N, N', \overline{K}, w)$ and $s' = j'(s, p', \tilde{p}', p, \tilde{p}, \bar{e}', N, N', \overline{K}, w)$ for the supplier and $p = f(p', s, \tilde{p}, s', \tilde{p}', \bar{e}, N, N', \overline{K}, w)$ and $s = j(s', p, \tilde{p}, p', \tilde{p}', \bar{e}, N, N', \overline{K}, w)$ for the receiver. For local property taxes, a similar case without cross-border shopping meant rate-increasing tax competition – with both property tax rates going up. Here, the receiving jurisdiction is more motivated to raise its property tax (to further increase sales tax revenue and rents). The incentive for the supplying municipality to follow is somewhat weakened by the additional tax revenue collected from its cross-border shopping consumers who exhibit a greater demand for housing. This is true, of course, if cross-border shopping is not entirely eliminated. Then a strategic reduction (or tax competition) in the sales tax by the supplying local government can stop short of matching its neighbour's rate. Rather, it can be decreased just enough to alleviate the

marginal cost of cross-border shopping and to attract some retail businesses back, but not too much as to retain higher property tax receipts.[137]

Case Three. Finally, there is *the possibility that the housing and private good demands are inversely related*, implying $h'_{s'} < 0$, $x'_{p'} < 0$ and $k'_{p'} = k'_{x'} x'_{p'} < 0$.[138] Under such preferences, the mobile shoppers would want to adjust their choices in favour of more x (now relatively cheaper for them at a lower after-tax price $1+s$ in the neighbouring jurisdiction) and reduce their consumption of housing. This change is shown in Figure 3.7 by a move from point E' with h' and x' to point E'_{cbs} with $\hat{h}'$ and $\hat{x}'$, $h' > \hat{h}'$ and $x' < \hat{x}'$. The changes are followed by a subsequent reduction in the public provision of services, now given by $(1-\alpha)p'h'(p',s') + \alpha p'\hat{h}'(p',s) + (1-\alpha)s'x'(p',s') + (\tilde{p}'-\bar{e}')k'(\tilde{p}',p',s',\bar{r},\alpha) = g'$. This time a decrease in g is caused not only by a direct erosion of the sales tax base and a flight of retail businesses, but also by a reduction in the taxable housing consumption of the cross-border shopping individuals (compared with two previous supplying

Figure 3.7



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[137] The promising empirical evidence for such fiscal interactions can be found in Ladd and Bradbury (1988). They discover that sales taxes have a positive but insignificant effect on the combined residential and commercial property tax base in large U.S. cities. The author of this research believes that Ladd and Bradbury's failure to separate the two property tax bases with opposite responses to sales taxes (positive for the residential property tax base and negative for the commercial property tax base) caused them to pick up a single dominant effect, which happens to be the residential property effect.

[138] Utility function $U = (h-h_0)^{\alpha}(x-x_0)^{\beta} + \ln g$ with corresponding demands $h^* = \frac{\alpha w + \beta(1+p)h_0 - \alpha(1+s)x_0}{(1+p)(\alpha+\beta)}$ and $x^* = \frac{\beta w + \alpha(1+s)x_0 - \beta(1+p)h_0}{(1+s)(\alpha+\beta)}$ (where h_0 and x_0 are subsistence quantities) yields the required relationship.

municipality cases). As the joint contribution of both of the subgroups of property taxes declines, $(1-\alpha)p'h'+\alpha p'\hat{h}' = p'h'-\alpha p'(h'-\hat{h}') < p'h'$, the level of public services provided by the municipality is expected to shrink even further.

The maximization of indirect individual utility, $V'(p',s',g')$, subject to the budget constraint above yields the municipal equilibrium conditions:

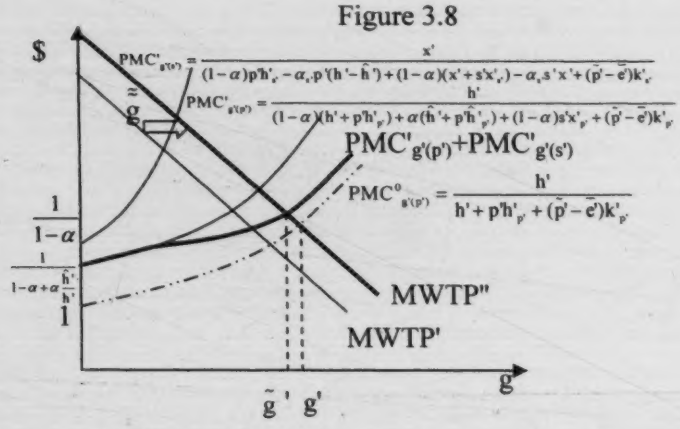
$$MWTP' = PMC'_{g'(p')} = \frac{h'}{(1-\alpha)(h'+p'h'_{p'})+\alpha(\hat{h}'+p'\hat{h}'_{p'})+(1-\alpha)s'x'_{p'}+(\tilde{p}'-\bar{e}')k'_{p'}} \quad \text{and}$$

$$MWTP' = PMC'_{g'(s')} = \frac{x'}{(1-\alpha)p'h'_{s'}-\alpha_{s'}p'(h'-\hat{h}')+(1-\alpha)(x'+s'x'_{s'})-\alpha_{s'}s'x'+(\tilde{p}'-\bar{e}')k'_{s'}}.$$

Undoubtedly, the government of the supplying municipality finds itself in a disadvantaged position right from the start by facing higher perceived marginal costs in terms of both local taxes. In the first equilibrium expression, a direct increase in the $PMC'_{g'(p')}$ comes from the induced reduction in the housing consumption of the cross-border shoppers $(h' > \tilde{h}')$. Graphically, this change implies an upward shift in the $PMC'_{g'(p')}$ schedule, with its initial value, $\frac{h'}{(1-\alpha)h'+\alpha\hat{h}'} = \frac{1}{1-\alpha+\alpha\frac{\hat{h}'}{h'}}$, becoming greater than 1 (see Figure 3.8). Because the demands for the two goods are negatively related, the terms $(1-\alpha)s'x'_{p'}$ and $(\tilde{p}'-\bar{e}')k'_{p'}$ contain additional negative effects of cross-border shopping, causing an inward rotation of the shifted $PMC'_{g'(p')}$ curve.

The second expression incorporates a direct increasing effect on the $PMC'_{g'(s')}$ of the partial erosion of the local sales tax base, $(1-\alpha)(x'+s'x'_{g'})$. This is also consistent with an upward shift of the $PMC'_{g'(s')}$ schedule, with a new initial value of $\frac{1}{1-\alpha}>1$. The overall increase in the $PMC'_{g'(s')}$ at any given level of g is actually larger after accounting for both sales tax and cross-border shopping effects on capital property investment, $(\tilde{p}'-\bar{e}')k'_{s'}<0$, and on housing consumption, $(1-\alpha)p'h'_{s'}-\alpha_{s'}p'(h'-\hat{h}')<0$ (the $PMC'_{g'(s')}$ curve is now steeper in Figure 3.8). With both cost schedules shifted to different extents (the new initial value of the $PMC'_{g'(s')}$ is greater than that of the $PMC'_{g'(p')}$, or $\frac{1}{1-\alpha}>\frac{1}{1-\alpha+\alpha\frac{\hat{h}'}{h'}}$ for any α), the total $PMC'_{g'}$ is inevitably reshaped. For its values between $\frac{1}{1-\alpha+\alpha\frac{\hat{h}'}{h'}}$ and $\frac{1}{1-\alpha}$, the $PMC'_{g'}$ coincides with the $PMC'_{g'(p')}$, and from $\frac{1}{1-\alpha}$ onwards, the $PMC'_{g'}$ becomes the horizontal sum of both perceived marginal costs (see $PMC'_{g'(p')}+PMC'_{g'(s')}$ in Figure 3.8). Along with an expected smaller net outward shift in the MWTP' curve, indicating a lower subsidy to the provision of the residential

Figure 3.8



public service due to capital relocation (by $\tilde{\tilde{g}}$ in Figure 3.8), these changes guarantee a rise in the equilibrium values of MWTP" and $PMC'_{g'}$ and a reduction in the equilibrium provision of public services ($\tilde{g}'$ in Figure 3.8) when compared with the two previous cross-border shopping cases.

The dynamics of municipal interactions depends on individual preferences in the receiving jurisdiction as well as on the degree of the cross-border shopping distortion in the supplying jurisdiction. Assuming $h_s < 0$, $x_p < 0$ and $k_p = k_x x_p < 0$ for the receiving municipality, its equilibrium conditions are given by

$$MWTP = PMC_{g(p)} = \frac{h}{h + ph_p + sx_p + (\tilde{p} - \bar{e})k_p}$$ and

$$MWTP = PMC_{g(s)} = \frac{x}{ph_s + x + sx_s + (\tilde{p} - \bar{e})k_s + (\alpha\hat{x}' + s\alpha_s\hat{x}' + s\alpha\hat{x}'_s)\delta}.$$ The reaction functions $p' = f'(p, s', \tilde{p}', s, \tilde{p}, \bar{e}', N, N', \bar{K}, w)$ and $s' = j'(s, p', \tilde{p}', p, \tilde{p}, \bar{e}', N, N', \bar{K}, w)$ for the supplying jurisdiction and $p = f(p', s, \tilde{p}, s', \tilde{p}', \bar{e}, N, N', \bar{K}, w)$ and $s = j(s', p, \tilde{p}, p', \tilde{p}', \bar{e}, N, N', \bar{K}, w)$ for the receiving jurisdiction suggest complex interactions of municipal taxes. Rate-reducing tax competition in residential property taxes seems the most likely outcome for municipalities. By decreasing its property tax and, thus, boosting local consumption of the private good, each municipality tries to attract and/or retain more business capital within its boundaries. The major effect of such a measure on the citizens' wellbeing (utility) is carried out through business property overtaxation, leading to the augmentation in the local public output.

The original asymmetry in the sales tax positions again implies different approaches by the jurisdictions to their choices of competitive strategies. The receiving municipality

is least inclined to adopt any big changes in its sales tax, being content with a small reduction, if any, to ease the tax burden on its own voters at the expense of the foreign shoppers. The supplying municipality, on the contrary, may have to consider more extreme adjustments. If an increase in the total perceived marginal cost due to cross-border shopping is expected to be large enough to cause a decline in the level of its public services compared with the equivalent case with only property taxation, the introduction of the sales tax should not occur. Under the oversimplified assumption of an unchanged subsidy, g is $\tilde{g}'$ under both taxes with $PMC'_{g'(p')} + PMC'_{g'(s')}$ versus g' with the property tax only and $PMC^{0}_{g'(p')}$ in Figure 3.8. Choosing not to impose the sales tax, this municipality is likely to provide more than just g' because the absence of the sales tax reverses the direction of cross-border shopping, encourages the inflow of business capital, and, in turn, increases the rents extracted in favour of local residents. Let's say that public provision without the use of a sales tax is given by $p''h'' + (\tilde{p}'' - \bar{e}')k'' = g''$. Since $(\tilde{p}'' - \bar{e}')k'' > (\tilde{p}' - \bar{e}')k'$, a single property tax system definitely performs better (that is, provides a higher level of the public output) if $p''h'' \geqslant (1-\alpha)p'h' + \alpha p'\hat{h}' + (1-\alpha)s'x'$. What is better depends again on α, whose absolute value reflects the responsiveness of the local mobile shoppers to tax differences. With $\alpha \geqslant \frac{p'h' + s'x' - p''h''}{p'h' + s'x' - p'\tilde{h}'}$, tax diversification is politically and economically costly to the supplying municipality because of distortionary cross-border shopping and downward competitive pressures on local taxes. If the supplying municipality does not have a sales tax, the receiving municipality, with its weaker demand for the private good, may experience only a small

outflow of shoppers to the former supplying municipality and may decide to keep its own sales tax at a fairly low rate.

Matching its neighbour's sales tax can be an option for the case of a small value of α. Assuming $s' = s$ and the same p', the adjusted level of the public output reaches $p'h''' + sx''' + (\tilde{p}''' - \bar{e}')k''' = g'''$, where $(\tilde{p}''' - \bar{e}')k''' > (\tilde{p}' - \bar{e}')k'$ due to the offsetting location disadvantages for retail businesses. It is sure to benefit the supplying municipality if $p'h''' + sx''' \geqslant (1-\alpha)p'h' + \alpha p'\hat{h}' + (1-\alpha)s'x'$ or $\alpha \geqslant \frac{p'h' + s'x' - p'h''' - sx'''}{p'h' + s'x' - p'\tilde{h}'}$. Since $p''h''$ is expected to be less than $p'h''' + sx'''$, the full condition on α for a full sales tax reduction to match its neighbour's rate is $\frac{p'h' + s'x' - p'h''' - sx'''}{p'h' + s'x' - p'\tilde{h}'} \leqslant \alpha < \frac{p'h' + s'x' - p''h''}{p'h' + s'x' - p'\tilde{h}'}$. Any other responses, including limited reductions in s', are likely to be insufficient and continue to impose high taxation costs on the municipal economy.

Table 3.2 summarizes the major results from this section where we have property and sales taxes, mobile capital and mobile shoppers. Diversification of local finances with sales taxes, it can be concluded, becomes more controversial under competitive interactions than in isolation. On one hand, it remains an attractive alternative for the government facing certain types of preferences (i.e. h and x being unrelated or positively related),[139] although the intermunicipal relationship always results in rate-reducing tax competition and leads to the adoption of relatively low sales tax rates. On the other hand,

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[139] There is no empirical evidence on how x is likely to be affected by the residential property tax ($x_p \gtreqless 0$) since most studies choose to investigate the impact of retail sales or sales taxes on the residential property tax base. Related empirical findings are mixed. Ladd and Bradbury (1988) claim no effect of sales taxes on property tax bases in 86 U.S. cities, whereas Wong (2004) reveals a positive relationship between retail activities and property tax bases in Kansas, making sales taxes a negative influence on both.

it can be undesirable if both goods are negatively impacted by local taxes. Then, by choosing not to include a distortionary sales tax in its fiscal structure, a jurisdiction strengthens its position as a retail shopping area and forces a downward adjustment in the sales tax of its neighbour. These predictions are generally consistent with the evidence of municipal sales taxes in the USA, where there are always municipalities that do not use sales taxes and most of those that do choose similar rates.

Table 3.2: Summary of Municipal Interactions in Property Taxes and Sales Taxes

	Conditions	**Reaction function**	**Expected dynamics of interactions**	**Details**
No cross-border shopping *Two property taxes* *Sales tax*	$x_p \gtrless 0$ $k_p \gtrless 0$ $k_s < 0$	$p = f(p', s, \tilde{p}, s', \tilde{p}', \bar{e}, N, N', \bar{K}, w)$ $s = j(s', p, \tilde{p}, p', \tilde{p}', \bar{e}, N, N', \bar{K}, w)$	Rate-increasing/ rate-reducing tax competition or no interaction in residential property taxes. Rate-reducing tax competition in sales taxes.	Given $k_s < 0$, a reduction in s is used to attract/retain retail businesses.
Cross-border shopping *Two property taxes* *Sales tax*	$h_s = 0$ $x_p = 0$ $k_p = 0$ $k_s < 0$	Receiving municipality: $p = f(p', s, \tilde{p}, s', \tilde{p}', \bar{e}, N, N', \bar{K}, w)$ $s = j(s', p, \tilde{p}, p', \tilde{p}', \bar{e}, N, N', \bar{K}, w)$ Supplying municipality: $p' = f'(p, s', \tilde{p}', s, \tilde{p}, \bar{e}', N, N', \bar{K}, w)$ $s' = j'(s, p', \tilde{p}', p, \tilde{p}, \bar{e}', N, N', \bar{K}, w)$	Secondary tax adjustments in residential property taxes. Rate-reducing tax competition in sales taxes.	Business property taxes are decreased to attract/retain retail businesses. The receiving municipality does not want to change its sales tax. The supplying municipality needs to reduce its sales tax to lessen the negative effect of cross-border shopping: it can either match the receiver's tax or decrease its tax, keeping it above the receiver's.
	$h_s > 0$ $x_p > 0$ $k_p > 0$ $k_s < 0$	Receiving municipality: $p = f(p', s, \tilde{p}, s', \tilde{p}', \bar{e}, N, N', \bar{K}, w)$ $s = j(s', p, \tilde{p}, p', \tilde{p}', \bar{e}, N, N', \bar{K}, w)$ Supplying municipality: $p' = f'(p, s', \tilde{p}', s, \tilde{p}, \bar{e}', N, N', \bar{K}, w)$ $s' = j'(s, p', \tilde{p}', p, \tilde{p}, \bar{e}', N, N', \bar{K}, w)$	Rate-increasing tax competition in residential property taxes. Rate-reducing tax competition in sales taxes.	Residential property taxes are increased to attract/retain retail businesses. The receiving municipality does not change its sales tax by much. The supplying municipality has to reduce its sales tax to lessen the shopper outflow: its decrease is likely to fall short of matching the receiver's tax rate.
	$h_s < 0$ $x_p < 0$ $k_p < 0$ $k_s < 0$	Receiving municipality: $p = f(p', s, \tilde{p}, s', \tilde{p}', \bar{e}, N, N', \bar{K}, w)$ $s = j(s', p, \tilde{p}, p', \tilde{p}', \bar{e}, N, N', \bar{K}, w)$ Supplying municipality: $p' = f'(p, s', \tilde{p}', s, \tilde{p}, \bar{e}', N, N', \bar{K}, w)$ $s' = j'(s, p', \tilde{p}', p, \tilde{p}, \bar{e}', N, N', \bar{K}, w)$	Rate-reducing tax competition in residential property taxes. Rate-reducing tax competition in sales taxes.	Residential property taxes are decreased to attract/retain retail businesses. The receiving municipality does not want to change its sales tax. The supplying municipality either has to reduce its sales tax all the way down to the receiver's rate to eliminate the shopper outflow or to give up its sales tax.

3.4. Two Taxes and One Publicly Provided Good with Commuting

Introduction of a wage income or payroll tax is an alternative way to diversify municipal tax bases. This section is included for two major reasons. First, there is a lack of theoretical justification for choosing a sales tax over a payroll tax, making both equally strong candidates.[140] Second, both the sales tax and payroll tax are widely used to complement slowly growing property tax revenue by municipalities in the USA and Western Europe. Thus, additional insight into municipal payroll taxation is needed to understand how its performance in a multi-jurisdictional setting differs from that of a local sales tax.

In isolation, consideration of payroll taxation for municipal tax base expansion was irrelevant. The assumption of wage exogeneity implied that a local payroll tax acquired lump sum characteristics and, so, would dominate the residential property tax on variable housing consumption. In the interjurisdictional competitive environment, this superiority of the municipal payroll tax is no longer present even though the interacting jurisdictions continue to face a common national or regional labour market (see example 4 in Appendix 3.7). A payroll tax becomes distortionary because: 1) its negative effect on the purchasing power of residents is transferred through the private good onto the retail sector, causing business capital flight (accompanied by a reduction in rents and voters' well-being) and 2) residents can commute (change work locations) in response to differences in the payroll tax (despite the differences in individual preferences between the municipalities). The next sections proceed to apply our MWTP-PMC analysis to the property and payroll taxes initially without and later with cross-border commuting.

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[140] Goodspeed (1989) actually argues that local governments using income taxation incur some inefficiency in resource allocation, as under any other distortionary tax, and some redistribution. Both effects are expected to be small and may not justify the recommendation to abstain from ability to pay taxes.

3.4.1. Property and Payroll Taxes, Changing Housing Consumption and Mobile Business Capital without Commuting

Adoption of a payroll tax reduces the demand for both h and x, through a reduction in each consumer's purchasing power. The utility maximization ratio, $\frac{U_h}{U_x} = 1 + p$, combined with the personal budget constraint, $(1+p)h + x = (1-t)w$, where t is the local payroll tax rate, yields $h^* = h^*(p,t)$ and $x^* = x^*(p,t)$. The corresponding indirect utility is given by $V(h^*, x^*, g) = V(p,t,g)$.

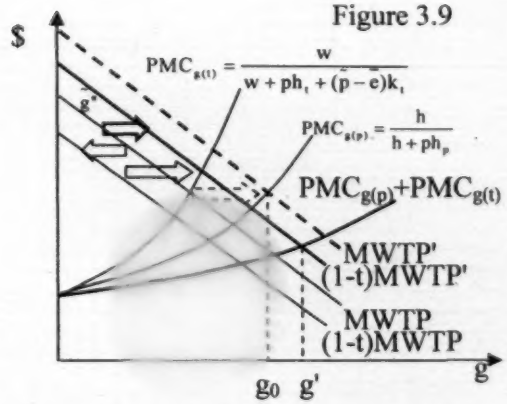
Suppose initially that no commuting is possible. Profit maximization of $R(k, x(p,t)) - \bar{r}k - \theta x(p,t) - \tilde{p}k$ with respect to k shows that per capita investment in commercial property becomes sensitive to local taxes, $k = k(\tilde{p}, p, t, \bar{r})$. While the property tax effect on business capital continues to depend on individual preferences, $k_p = k_x x_p \gtrless 0$, the payroll tax effect on business capital is sure to be negative, $k_t = k_x x_t < 0$. With no commuting, a decline in the sales of x due to t is followed by a reduction in the retail business presence in the municipality.

The municipal government, committed to individual utility maximization and a balanced budget, $ph(p,t) + tw + (\tilde{p} - \bar{e})k(\tilde{p}, p, t, \bar{r}) = g$, now chooses its fiscal policies according to the new equilibrium conditions $(1-t)MWTP = PMC_{g(p)} = \frac{h}{h + ph_p + (\tilde{p} - \bar{e})k_p}$ and $(1-t)MWTP = PMC_{g(t)} = \frac{w}{w + ph_t + (\tilde{p} - \bar{e})k_t}$. Although the right-hand side of these equations is familiar, it is the distribution of tax distortions between its MWTP and

PMC sides that is different.[141] The $PMC_{g(p)}$ curve may be steeper or flatter (depending on $x_p, k_p > 0$, $x_p, k_p = 0$ or $x_p, k_p < 0$), but its starting value is 1 in each case. The $PMC_{g(t)}$ expression also implies an upward sloping curve, beginning at 1. If wage income taxation is assumed to be relatively more costly than residential property taxation, the $PMC_{g(t)}$ curve lies above the $PMC_{g(p)}$ curve (Figure 3.9 also assumes $x_p = 0$ and $k_p = 0$). The horizontal summation of these curves, $PMC_g = PMC_{g(p)} + PMC_{g(t)}$, reflects a lower overall marginal cost of g under tax diversification.

The voters' MWTP is subject to two opposing effects. The first is induced by the loss of individual disposable income due to the payroll tax (an inward shift from MWTP to (1−t)MWTP in Figure 3.9). The second results from the transfer of business property rents to local residents, acting as an individual income subsidy and shifting the MWTP to the right (an outward shift from (1−t)MWTP to (1−t)MWTP' in Figure 3.9).[142] A rent maximization policy effectively ties the business property tax to the residential property and payroll taxes. Total differentiation of $k(\tilde{p}, p, t) + (\tilde{p} - \bar{e})k_{\tilde{p}}(\tilde{p}, p, t) = 0$ when $k_{\tilde{p}\tilde{p}} = 0$, $k_{\tilde{p}p} = 0$ and $k_{\tilde{p}t} = 0$ reveals that a business-residential property tax relationship is shaped by the local

Figure 3.9



[141] The equilibrium conditions are consistent with the presentation of state taxation of labour income in Dahlby and Wilson (1996).

[142] Generally, these shifts in the MWTP curve are likely to be non-parallel. Parallel shifts in Figure 9 are adopted for simplicity, as in either case the analysis remains qualitatively identical.

responses, $\frac{\partial \tilde{p}}{\partial p} = -\frac{k_p}{2k_{\tilde{p}}} \gtrless 0$, while a business property-payroll tax relationship is independent of these responses and is definitely negative, $\frac{\partial \tilde{p}}{\partial t} = -\frac{k_t}{2k_{\tilde{p}}} < 0$. The latter suggests a lower t to ensure a higher $\tilde{p}$ and greater business rents. If so, the business subsidy effect on the MWTP is expected to be greater than the wage taxation effect and there is a likely net increase in public provision of services (denoted by $\tilde{g}$" in Figure 3.9). The amount of the per capita municipal services actually available to residents is still determined by the equality of the adjusted MWTP and the overall PMC_g (which corresponds to g' in Figure 3.9).

There are two major conclusions that can be drawn about the use of the payroll tax in this model. First, the newly expanded tax system compares favourably with the single property tax system. If any change in business rent is ignored for simplicity, the MWTP under the property tax only would shift to the dashed MWTP' (the shift indicated by the dashed arrow and the same in magnitude as the shift from $(1-t)$MWTP to $(1-t)$MWTP') and the equilibrium quantity of the public output would become g_0 in Figure 3.9. Thus, by diversifying its taxes the local government can provide more of its services ($g_0 < g'$) at a lower cost. Second, the payroll tax may be a less attractive municipal fiscal instrument than the sales tax. With payroll taxation in place, the MWTP is reduced, not only through a decline in the amount of the subsidy to the local residents due to capital flight from the municipality, but also through a direct decrease in

the voter's purchasing power.[143] These two distortions on the MWTP should be expected to contribute to its larger decline than a single reduction in the subsidy through capital flight induced by sales taxation under the absence of cross-border shopping. Thus, the sales tax seems to be a more effective tool for converting business rents into greater public provision of services to local citizens (whereas it is likely to be equally good at reducing the overall perceived marginal cost of the public output).

Capital scarcity, $kN + k'N' = \overline{K}$, and capital return equalization, $R_k(k, x(p)) - \tilde{p} = \bar{r} = R'_{k'}(k', x'(p')) - \tilde{p}'$, when combined with the equilibrium expressions above, condition the fiscal policies of the municipal government in question on the policies of its neighbour. The reaction function for the local residential property tax, $p = f(p', t, \tilde{p}, t', \tilde{p}', \bar{e}, N, N', \overline{K}, w)$, suggests dynamics consistent with either rate-increasing tax competition (if $x_p, k_p > 0$, the post-interactive equilibrium property tax rate is increased), or secondary relationships to maintain $PMC_{g(p)} = PMC_{g(t)}$ (if $x_p, k_p = 0$), or rate-reducing tax competition (if $x_p, k_p < 0$, the equilibrium property tax rate with tax competition is lowered) – whatever proves to be the best adjustment, given the underlying individual preferences, for retaining business investment within the jurisdiction to preserve the source of the residential subsidy. In terms of the payroll tax, the municipal reaction function looks like $t = q(t', p, \tilde{p}, p', \tilde{p}', \bar{e}, N, N', \overline{K}, w)$. But unlike the multiple possibilities with the residential property tax, the only way the local government is going to change its payroll tax is downwards. Decreases in the payroll tax rate, while producing a limited effect on the utility level through h and x, help minimize

[143] In contrast, while the sales tax also reduces purchasing power and consumption of the private good, consumption of housing may decrease, remain unchanged or even increase.

the utility loss through capital departure. Also, by lowering t the government encourages local people to shop more, thus, bringing more business to the retail sector in the jurisdiction. The measure effectively reduces the double distortion on the MWTP. It moderates the leftward shift in the MWTP (as $1-t$ rises with a decline in t) and augments its rightward shift (as $(\tilde{p}-\bar{e})k$ grows with a decline in t). Facing normal consumption goods, the other municipality is forced to follow with a decrease in its own payroll tax to avoid the loss of its commercial property investment and rents. Thus, municipal interactions in payroll taxes are expected to result in rate-reducing tax competition.

3.4.2. Property and Payroll Taxes, Changing Housing Consumption and Mobile Business Capital with Commuting

Payroll taxation results in far more complex adjustments in the local economy once residents can commute between jurisdictions for work. Before turning to that discussion, it is useful to reflect briefly on commuting in the literature.

Empirical research links commuting to a number of economic factors (as well as social and geographic ones). According to estimates done by Eliasson, Lindgren and Westerlund (2003) on Swedish cities, commuting is preferred to migration when there is a common labour market encompassing many municipalities offering a range of choices in housing consumption. In a study of U.S. cities, Plaut (2006) found that homeowners commute more than renters and commuting decisions are sensitive to interjurisdictional income differentials (interestingly, this latter effect is stronger for women).[144] The three

[144] Impacts of social factors are found and discussed in both Eliasson, Lindgren and Westerlund (2003) and Plaut (2006). For example, couples prefer commuting over migrating and men tend to commute more than women.

characteristics noted in the Swedish study also characterize our model, so it may be considered to provide an environment that is consistent with commuting.

Commuting patterns are expected to depend upon after tax wages or, more exactly, differences among jurisdictions. Given a common before tax wage faced by both jurisdictions (and taste differences satisfied by people's prior sorting) imposing a municipal payroll tax will motivate some local homeowners to pursue higher after tax earnings across the border. Because they choose to commute to the neighbouring municipality to work, their wage income is not taxed under the source-based payroll tax of their home jurisdiction.[145] On the other hand, their workplace municipality enjoys financial benefits from tax diversification with its own source-based payroll tax, plus it captures additional tax revenue from commuters. Once again, the latter can be referred to as the "receiving municipality" and the former can be referred to as the "supplying municipality".

Our approach to commuting has its differences and similarities in comparison with other commuting models. In our model, wages are exogenous and uniform, but in some models (e.g., Braid (2005) and Kächelein (2003)) wages are determined by the local production process and may vary across municipalities. Like Braid (2005), we assume that both payroll taxes are source-based,[146] and as in de Bartolome and Ross (2003), we assume that travel distances limit commuting to only a fraction of local residents. This contrasts with Braid who assumed commuting to be costless. Our assumption that residents prefer commuting to migration is consistent with the assumption of de

[145] Source-based payroll taxes are the most common type of payroll tax used by municipalities in the United States according to Inman (2005).
[146] The effects of a source-based payroll tax are shown to be quite different from the effects of a residence-based payroll tax in Hettler (2004).

Bartolome and Ross that income after taking account of the cost of commuting cannot fall short of land rents. Also, like Kächelein (2003), decisions with respect to the local public output take account only of the interests of local residents, which removes any influence of commuters.

Our assumptions are reasonable and suit our objectives. These are to understand municipal interactions in the presence of payroll taxes and to identify the advantages or disadvantages of employing a payroll tax versus a sales tax at the local government level. This is done by comparing the outcomes of the commuting model with those of the cross-border-shopping model of the previous section.

Receiving municipality. When introducing a payroll tax, a municipality in our model will pay particular attention to two factors. One factor is, as in the no commuting situation, the responsiveness of private good consumption to the payroll tax, t, because lower x results in lower k as capital moves away, which erodes the business property tax base. The other factor is the responsiveness of potential commuters to payroll tax rates because these workers are sensitive to differences in net wages, $(1-t)w \gtreqless (1-t')w$, and in-commuting augments the payroll tax base while out-commuting diminishes it. We assume that the net inflow of commuters to the receiving municipality is characterized by $\beta(t,t') = \beta(t'-t)$, where t' is the payroll tax rate of the supplying municipality, t is the tax rate of the receiving municipality, β is positive as long as $t < t'$ and goes to zero at $t = t'$, and $\beta < 0.5$. The $\beta(t'-t)$ function denotes the fraction of N' in the supplying municipality who commute to the receiving municipality. From the perspective of the municipality levying payroll tax t, $\beta' > 0$. When $t < t'$, $\beta(t,t')N'$ commuters enter this (the t levying) municipality and generate an increase in per capita payroll tax revenue of

$t\beta(t,t')w\delta$, where $\delta = \frac{N'}{N}$ is the ratio of the populations of the supplying and receiving municipalities.

The use of capital related only to retail sales somewhat simplifies the commuting setting. Since commuters work for firms without k, more employment in the receiving municipality does not require or imply more investment in k. If commuters are also assumed not to do any major shopping in the jurisdiction of their workplace, commuting does not produce any change in the business profit condition, $R(k, x(p,t)) - r\bar{k} - \theta x(p,t) - \tilde{p}k$, compared with the case of no commuting. In the same way, profit maximization with respect to k defines per capita business property investment as a function of all municipal taxes, $k = k(\tilde{p}, x(p,t), r) = k(\tilde{p}, p, t, r)$, where the entire effect of the local payroll tax is carried out through x and remains negative $k_x x_t < 0$ as $k_x > 0$ and $x_t < 0$. The impact of the residential property tax continues to depend on the individual preferences linking h and x (positive, negative or not related).

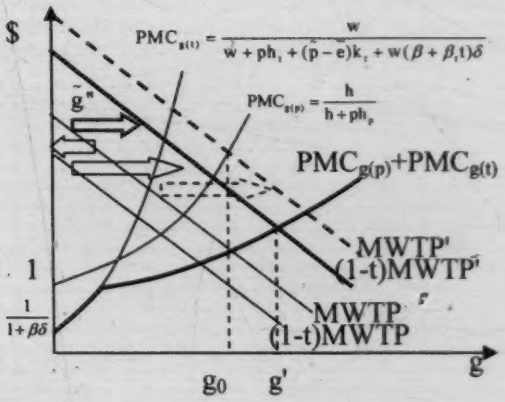
For the receiving municipality, commuting serves as a means of expanding its payroll tax base without incurring further political or expenditure responsibilities. Since its direction and volume are easily predictable (based on the payroll tax difference), the effect of commuting is directly incorporated in the public budget constraint, $ph(p,t) + tw + (\tilde{p} - \bar{e})k(\tilde{p}, p, t, \bar{r}) + t\beta(t,t')w\delta = g$, and through it into the equilibrium conditions guiding fiscal policies of the utility maximizing municipal government

$$(1-t)MWTP = PMC_{g(p)} = \frac{h}{h + ph_p + (\tilde{p} - \bar{e})k_p} \quad \text{and}$$

$$(1-t)MWTP = PMC_{g(t)} = \frac{w}{w + ph_t + (\tilde{p} - \bar{e})k_t + w(\beta + \beta_t t)\delta}.$$

The first expression indicates that the government choice of the residential property tax is unaffected by commuting activity. The $PMC_{g(p)}$ curve remains positioned, as it would be without any commuting, preserving a minimum value of 1 (see Figure 3.10 where h and x are assumed unrelated, $x_p = 0$ and $k_p = k_x x_p = 0$). In contrast, the second expression absorbs the full direct marginal effect of commuting, given by $w(\beta + \beta_t t)\delta$.[147] By selecting its payroll tax so that this marginal effect is positive, $w(\beta + \beta_t t)\delta = w\beta(1+\varepsilon_t^{\beta})\delta > 0$, the receiving municipality partially or completely offsets the negative effect on the retail property, $(\tilde{p}-\bar{e})k_t < 0$, which decreases the steepness of the $PMC_{g(t)}$ curve relative to the no commuting case. In addition, commuting also forces an overall downward adjustment of the $PMC_{g(t)}$ curve, making its initial value drop to $\frac{w}{w + w\beta\delta} = \frac{1}{1+\beta\delta} < 1$ (see Figure 3.10).

Figure 3.10



At the equilibrium, where the MWTP crosses the total $PMC_g = PMC_{g(p)} + PMC_{g(t)}$, both sides are transformed by commuting. On the perceived marginal cost side, the PMC_g curve becomes discontinuous. Between of its values of $\frac{1}{1+\beta\delta}$ and 1, it coincides with the $PMC_{g(t)}$ function and, from 1 on, it is given by the horizontal summation of both

[147] The smaller in population size is the receiving municipality relative to the supplying municipality, the more it can benefit from in-commuting ($\delta >> 1$). This conclusion is consistent with Schmidheiny's (2006) claims that even a richer community sets a lower income tax rate if it is small in size.

perceived marginal costs. The reduction in PMC_g is mainly derived from the inflow of commuters and the resulting decrease in the $PMC_{g(t)}$ for any g. (Figure 3.10 illustrates the case of unrelated h and x, implying no capital influence on the position of the $PMC_{g(p)}$ curve.) On the demand side, the MWTP declines under payroll taxation from MWTP to $(1-t)$MWTP (shown in Figure 3.10 as a parallel shift), but it is also shifted right by the subsidy, consisting of rents from the business sector and the payroll taxes of commuters, from $(1-t)$MWTP to $(1-t)$MWTP' in Figure 3.10. This rightward change is expected to be greater in magnitude than the previous leftward shift. Together the lower PMC_g and the higher MWTP result in the enhanced provision of municipal services, given by g' in Figure 3.10. The receiving municipality does better not only by redistributing a part of the tax burden towards the newly adopted payroll tax (i.e. tax diversification), but also by shifting some of the tax burden to non-residents.[148] Were only a single property tax used, and if the amount of the per person subsidy is assumed unchanged, this jurisdiction would provide only g_0, which is a lower level of municipal services, $g_0 < g'$, and provide this amount at a higher cost to local voters.

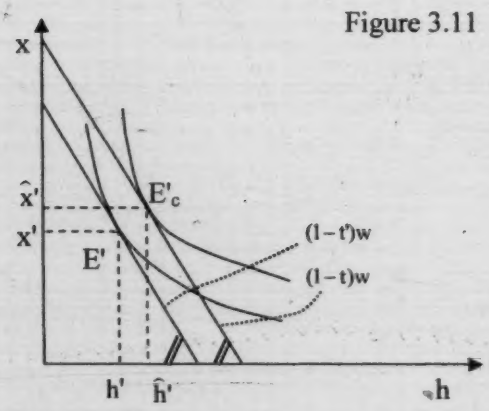
Supplying municipality. This municipality is disadvantaged by its more income inelastic preferences for the private good, leading to its optimal choice of a higher payroll tax and an outflow of its working citizens, willing to commute elsewhere for a higher net wage. Facing payroll tax base erosion, the supplying municipality is expected to act by either reducing or eliminating its payroll tax. To understand why a certain type of fiscal

[148] It is no longer possible to explicitly derive the ratio of the tax rates under the general function forms. But tax burden redistribution is illustrated in the Figure 3.10 for any values of PMC_g greater than 1.

action is selected by its government, the distortionary impact of the outflow of commuters on all local participants have to be examined.

The fact that the option to commute is not exercised by everyone in the supplying municipality divides its people into two groups: commuters and non-commuters. The former earn a higher net income $(1-t)w$ across the border, which allows them to buy more housing and private good in their home jurisdiction ($\hat{h}'$ and $\hat{x}'$ at the equilibrium consumption point E'_c in Figure 3.11). The non-commuters have a lower after tax income $(1-t')w$ and consume less of both goods (h' and x' at the equilibrium point E' in Figure 3.11, $h'<\hat{h}'$ and $x'<\hat{x}'$). The commercial sector responds to the resulting adjustment in its per capita sales of the private good, $(1-\beta(t,t'))x'(p',t')+\beta(t,t')\hat{x}'(p',t)$. Its new profit maximization of $R'(k',(1-\beta)x'(p',t')+\beta\hat{x}'(p',t))-\bar{r}k'-[(1-\beta)\theta x'(p',t')+\beta\theta\hat{x}'(p',t)]-\tilde{p}'k'$ with respect to k yields $k'=k'(\tilde{p}',x'(p',t'),\hat{x}'(p',t),\beta(t,t'),\bar{r})=k'(\tilde{p}',p',t',t,\bar{r})$. Clearly, the payroll tax has a negative effect on retail property investment, $k'_{t'}=k'_{x'}x'_{t'}+k'_{\beta}\beta_{t'}$. However, the direct effect, $k'_{x'}x'_{t'}<0$, is mitigated by commuters realizing a larger disposable income and, so, spending more on the private good, $k'_{\beta}\beta_{t'}>0$.[149] The local government

Figure 3.11



[149] Theoretically, it is possible for $k'_{t'}$ to be positive if the demand for x' is fairly income inelastic and commuting volume is very responsive to payroll tax differences. But in practice, this would imply very low per capita payroll tax revenue, which would not justify the preservation of the payroll tax in the supplying municipality.

budget constraint reflects these interactions. That is

$(1-\beta(t,t'))p'h'(p',t')+\beta(t,t')p'\hat{h}'(p',t)+t'(1-\beta(t,t'))w+(\tilde{p}'-\bar{e}')k'(\tilde{p}',p',t',t,\bar{r})=g'$

(where $(1-\beta)p'h'+\beta p'\hat{h}'$ is the per capita residential property tax revenue from both groups of individuals and $t'(1-\beta)w$ is the per capita payroll tax revenue from non-commuters). The local government maximizes indirect individual utility yielding the equilibrium conditions:

$$(1-t')MWTP'=PMC'_{g'(p')}=\frac{h'}{(1-\beta)(h'+p'h'_{p'})+\beta(\hat{h}'+p'\hat{h}'_{p'})+(\tilde{p}'-\bar{e}')k'_{p'}} \quad \text{and}$$

$$(1-t')MWTP'=PMC'_{g'(t')}=\frac{w}{(1-\beta)p'h'_{t'}+\beta_{t'}p'(\hat{h}'-h')+(1-\beta)w-\beta_{t'}t'w+(\tilde{p}'-\bar{e}')k'_{t'}}.$$

Commuting-induced changes are evident in both perceived marginal cost expressions. The $PMC'_{g'(p')}$ curve shifts downwards, now beginning at $\frac{h'}{(1-\beta)h'+\beta\hat{h}'}=\frac{1}{1-\beta+\beta\frac{\hat{h}'}{h'}}<1$ (as $\frac{\hat{h}'}{h'}>1$ and $1-\beta+\beta\frac{\hat{h}'}{h'}>0$). Its reduction for any g' becomes possible due to the inclusion of the commuters' higher housing consumption into the residential property tax base of the supplying municipality. Also, for any given relationship between h' and x', $x'_{p'}\gtrless 0$ and, thus, $k'_{p'}\gtrless 0$, this curve gets somewhat flatter since, at any tax rate p', $\hat{h}'+p'\hat{h}'_{p'}$ is expected to be greater than $h'+p'h'_{p'}$ (the $PMC'_{g'(p')}$ for $x'_{p'}=0$ and $k'_{p'}=0$ is illustrated in Figure 3.12).[150] In contrast, the

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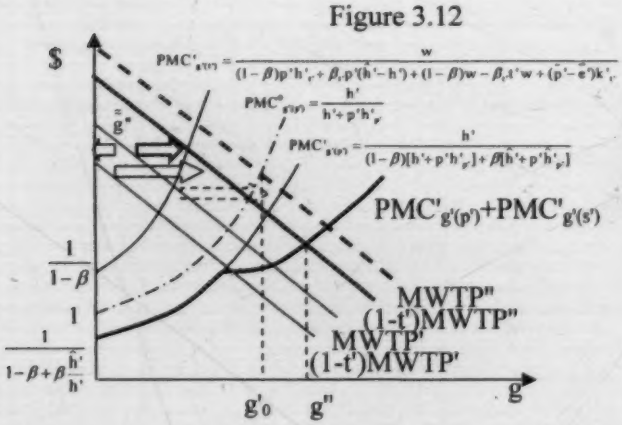
[150] Because $\hat{h}'+p'\hat{h}'_{p'}=\hat{h}'(1+\varepsilon^{\hat{h}'}_{p'})$, $h'+p'h'_{p'}=h'(1+\varepsilon^{h'}_{p'})$ and $\hat{h}'>h'$, at the same tax p', $\varepsilon^{\hat{h}'}_{p'}=\frac{\partial\hat{h}'}{\partial p'}\frac{p'}{\hat{h}'}\gtrless\varepsilon^{h'}_{p'}=\frac{\partial h'}{\partial p'}\frac{p'}{h'}$ and then $\hat{h}'(1+\varepsilon^{\hat{h}'}_{p'})>h'(1+\varepsilon^{h'}_{p'})$.

$PMC'_{g'(t')}$ schedule is adjusted upwards, reaching a higher minimum value of $\frac{w}{(1-\beta)w} = \frac{1}{1-\beta} > 1$. An overall increase in this portion of perceived marginal cost may be somewhat faster or slower, depending on which effect dominates – the denominator reducing (and, thus, cost increasing) effect of the erosion of the payroll tax base given by $(1-\beta)w > 0$ and $-\beta_{t'}t'w < 0$ or the denominator enhancing (and so cost decreasing) effect of the differentiation in housing consumption given by $(1-\beta)p'h'_{t'} < 0$ and $\beta_{t'}p'(\hat{h}'-h') > 0$ along with a reduction in the absolute value of the negative impact on business property $(\tilde{p}'-\bar{e}')k'_{t'} < 0$ discussed earlier. The $PMC'_{g'(t')}$ curve in Figure 3.12 assumes that the new effects approximately offset each other. Therefore, the total $PMC'_{g'}$ is discontinuous, overlapping with the $PMC'_{g'(p')}$ between its values of $\frac{1}{1-\beta+\beta\frac{\hat{h}'}{h'}}$ and $\frac{1}{1-\beta}$, and consisting of the horizontal summation of $PMC'_{g'(p')}$ and $PMC'_{g'(t')}$ from $\frac{1}{1-\beta}^{\circ}$ onwards. The MWTP' experiences the same transformations as in the case of no commuting: first a leftward shift from MWTP' to (1−t')MWTP' in Figure 3.12 owing to wage income taxation and then a rightward shift from (1−t')MWTP' to

Figure 3.12



$(1-t')MWTP''$ owing to the rents from the business sector. If a predicted increase in the collective rents is ignored (in other words, the distance between $(1-t')MWTP'$ and $(1-t')MWTP''$ is the same as between $MWTP'$ and $MWTP''$), $MWTP' = PMC'_{g'}$ and there is a rise in equilibrium public provision, g'' compared with g'_0 for the similar case of the single property tax in Figure 3.12.

Capital scarcity, $kN + k'N' = \overline{K}$, and capital return equalization, $R_k(k, x(p,t)) - \tilde{p} = \bar{r} = R'_{k'}(k', (1-\beta)x'(p',t') + \beta\hat{x}'(p',t)) - \tilde{p}'$, continue as a form of municipal interdependence. Keeping the functional forms general limits the possibilities for analysis of the municipal interactions to the case of symmetric individual preferences. If the private good and housing are unrelated in both jurisdictions, the reaction functions are $p = f(p', t, \tilde{p}, t', \tilde{p}', \bar{e}, N, N', \overline{K}, w)$ and $t = q(t', p, \tilde{p}, p', \tilde{p}', \bar{e}, N, N', \overline{K}, w)$ for the receiving municipality and $p' = f'(p, t', \tilde{p}', t, \tilde{p}, \bar{e}', N, N', \overline{K}, w)$ and $t' = q'(t, p', \tilde{p}', p, \tilde{p}, \bar{e}', N, N', \overline{K}, w)$ for the supplying municipality. Although there is a secondary relationship between the residential property and other taxes of the two municipalities, these tax rates are affected through own payroll taxes (which is consistent with the empirical findings of Ladd and Bradbury (1988)).[151] At the same time, the receiving jurisdiction must keep its payroll tax low to enjoy tax exporting through the foreign commuters. To avoid losing a segment of the commercial sector to the neighbour's lower taxation, the supplying municipality is compelled to cut its own payroll tax, but the reduction in its rate is deterred by the presence of the benefits from

[151] Ladd and Bradbury (1988) determine that city income taxes reduce the size of a city's property tax base, which is not the case with city sales taxes. Consistent with their findings, the sales tax in the case of no relationship between h and x is shown here to have no effect on residential property taxation.

the commuters' outflow (they bring back higher income and spend more on the consumption goods). Rate-reducing tax competition that develops between the two is likely to be moderate.

If the private good and housing are positively related, the reaction functions include all local taxes, $p = f(p', t, \tilde{p}, t', \tilde{p}', \bar{e}, N, N', \overline{K}, w)$ and $t = q(t', p, \tilde{p}, p', \tilde{p}', \bar{e}, N, N', \overline{K}, w)$ for the receiver and $p' = f'(p, t', \tilde{p}', t, \tilde{p}, \bar{e}', N, N', \overline{K}, w)$ and $t' = q'(t, p', \tilde{p}', p, \tilde{p}, \bar{e}', N, N', \overline{K}, w)$ for the supplier. The difference in the jurisdictional interactions exists only in the residential property taxes. Since any increase in the property tax induces a trade off between more expensive housing and the cheaper private good in favour of the latter and, thus, helps retain local businesses within municipal borders, there is rate-increasing tax competition in property taxes. The relationship between the two payroll taxes is based on rate-reducing tax competition as a decline in private good sales after wage income taxation is alleviated through reductions in the payroll taxes. The intensity of payroll rate-reducing tax competition proves to be less under commuting for the same reasons discussed earlier.

Finally, if the private good and housing are negatively related in both jurisdictions, the reaction functions become $p = f(p', t, \tilde{p}, t', \tilde{p}', \bar{e}, N, N', \overline{K}, w)$ and $t = q(t', p, \tilde{p}, p', \tilde{p}', \bar{e}, N, N', \overline{K}, w)$ for the receiving local government and $p' = f'(p, t', \tilde{p}', t, \tilde{p}, \bar{e}', N, N', \overline{K}, w)$ and $t' = q'(t, p', \tilde{p}', p, \tilde{p}, \bar{e}', N, N', \overline{K}, w)$ for the supplying local government. The two jurisdictions are expected to compete in terms of the residential property tax by cutting their tax rates to boost private good consumption and, thus, to improve retail business conditions within their borders. In addition, the municipalities continue to face rate-reducing tax competition in the payroll tax.

There is empirical evidence to support all three combinations of municipal reactions with respect to payroll and property taxes. The interactions among the Swiss communes are well researched. They fit well the first profile of independent determination of the residential property tax and tax competition in income taxes. For example, Feld and Kirchgässner (2001 and 2002) detect a positive relationship among the income taxes of the Swiss cities. Subsequently, Feld, Kirchgässner and Schaltegger (2003) reveal that these taxes in Switzerland tend to decrease under decentralization, whereas no such changes in property taxes are observed. In contrast, estimates on other European data favour the other two scenarios. Binet (2003) finds positive relationships between local payroll and property taxes in France, which she identifies as rate-reducing tax competition (both taxes are reduced to make a jurisdiction attractive for people and firms). Heyndels and Vuchelen (1998) are more careful with their conclusions about the Belgian municipalities that display a strong interdependence in income and property taxes. They recognize that positive relationships can be consistent with either rate-reducing or rate-increasing tax competition and leave the dynamics of the interactions unspecified.

Table 3.3 summarizes the major results from this section in which the analysis incorporates property and payroll taxes, mobile capital and commuters. In the case of both sales and payroll taxes, the arising externalities (cross-border shopping and commuting, respectively) are shown to make tax diversification at the local level more complex and controversial. But, it is under those conditions that the municipal payroll tax may be concluded to perform better. In the model presented, the payroll tax seems to enjoy two major advantages over the sales tax. First, there is less uncertainty about the

resulting outcome for the supplying municipality (loss in its payroll tax base is always somewhat offset by a gain in its property tax base) and, thus, there is a lower probability that it will abandon the payroll tax. Second, because certain reductions in total perceived marginal costs occur in both jurisdictions (due to the decrease in the $PMC_{g(t)}$ for the receiving government and due to the decrease in the $PMC'_{g'(p')}$ for the supplying government), less intense interactions develop. In the tax exporting competitive environment, the importance of these positive aspects of payroll taxation may easily outweigh, for local residents and their government, its major disadvantage for tax diversification purposes – the reduction in the individual MWTP.

Table 3.3: Summary of Municipal Interactions in Property Taxes and Payroll Taxes

	Conditions	**Reaction function**	**Expected type of interactions**	**Details**
No commuting *Two property taxes* *Payroll tax*	$x_p \gtrless 0$ $k_p \gtrless 0$ $k_t < 0$	$p = f(p', t, \tilde{p}, t', \tilde{p}', \bar{e}, N, N', \bar{K}, w)$ $t = q(t', p, \tilde{p}, p', \tilde{p}', \bar{e}, N, N', \bar{K}, w)$	Rate-increasing/ rate-reducing tax competition or no interactions in residential property taxes. Rate-reducing tax competition in payroll taxes.	Given $k_t < 0$, a reduction in t is used to attract/retain retail businesses through an increase in the residents' purchasing power.
Commuting *Two property taxes* *Payroll tax*	$h_t < 0$ $x_t < 0$ $x_p = 0$ $k_p = 0$ $k_t < 0$	Receiving municipality: $p = f(p', t, \tilde{p}, t', \tilde{p}', \bar{e}, N, N', \bar{K}, w)$ $t = q(t', p, \tilde{p}, p', \tilde{p}', \bar{e}, N, N', \bar{K}, w)$ Supplying municipality: $p' = f'(p, t', \tilde{p}', t, \tilde{p}, \bar{e}', N, N', \bar{K}, w)$ $t' = q'(t, p', \tilde{p}', p, \tilde{p}, \bar{e}', N, N', \bar{K}, w)$	Secondary tax adjustments in residential property taxes. Rate-reducing tax competition in payroll taxes.	Business property taxes are decreased to attract/retain retail businesses. The receiving municipality limits its reduction of the payroll tax. The supplying municipality needs to reduce its payroll tax to lessen a negative effect of income taxation: it unlikely to match the receiver's tax, but rather to decrease its tax, keeping it above the receiver's.
	$h_t < 0$ $x_t < 0$ $x_p > 0$ $k_p > 0$ $k_t < 0$	Receiving municipality: $p = f(p', t, \tilde{p}, t', \tilde{p}', \bar{e}, N, N', \bar{K}, w)$ $t = q(t', p, \tilde{p}, p', \tilde{p}', \bar{e}, N, N', \bar{K}, w)$ Supplying municipality: $p' = f'(p, t', \tilde{p}', t, \tilde{p}, \bar{e}', N, N', \bar{K}, w)$ $t' = q'(t, p', \tilde{p}', p, \tilde{p}, \bar{e}', N, N', \bar{K}, w)$	Rate-increasing tax competition in residential property taxes. Rate-reducing tax competition in payroll taxes.	Residential property taxes are increased to attract/retain retail businesses. The receiving municipality keeps its payroll tax low. The supplying municipality has to reduce its payroll tax to lessen the negative effect on businesses. Its decrease is likely to fall short of matching the receiver's tax rate due to the benefits from higher commuters' income.
	$h_t < 0$ $x_t < 0$ $x_p < 0$ $k_p < 0$ $k_t < 0$	Receiving municipality: $p = f(p', t, \tilde{p}, t', \tilde{p}', \bar{e}, N, N', \bar{K}, w)$ $t = q(t', p, \tilde{p}, p', \tilde{p}', \bar{e}, N, N', \bar{K}, w)$ Supplying municipality: $p' = f'(p, t', \tilde{p}', t, \tilde{p}, \bar{e}', N, N', \bar{K}, w)$ $t' = q'(t, p', \tilde{p}', p, \tilde{p}, \bar{e}', N, N', \bar{K}, w)$	Rate-reducing tax competition in residential property taxes. Rate-reducing tax competition in payroll taxes.	Residential property taxes are decreased to attract/retain retail businesses. The receiving municipality is prone to a small reduction in its payroll tax. The supplying municipality follows with a decrease in its own payroll tax, but stops short of matching the neighbour's tax rate.

3.5. Conclusions

The consequences of municipal tax diversification in an environment with interjurisdictional tax competition, using either the sales tax or the payroll tax, can be summarized as follows.

Discrimination between residential and business property for taxation purposes is in the political interest of a utility maximizing municipal government and economically beneficial for the local residents-voters.

Business capital scarcity induces municipal competition for this taxable resource, making local taxes even more distortionary. However, the extent of the distortion is shown to depend on individual preferences as well as on the absence or presence of consumers' and workers' mobility in the region.

The sales and payroll tax rates tend to decline under municipal tax competition. In spite of the rate-reducing tax competition, tax base expansion with either tax allows a local government to decrease the perceived marginal cost of public service provision. Thus, as a rule, the two-tax system continues to present a better option for municipalities in a multi-jurisdictional setting than a single tax system. The only exception is the third case under cross-border shopping when $x_p < 0$, $k_p < 0$ and $x'_{p'} < 0$, $k'_{p'} < 0$.

Access to business property taxation relieves fiscal pressure on governments, but inevitably passes a part of the tax distortion onto the MWTP through the amount of the per capita subsidy provided to local voters. The effect is particularly important in the case of payroll taxation since it causes an immediate reduction in the demand for the public service (given by the MWTP curve). In view of the two and likely larger distortions on the MWTP with the payroll tax (first, due to the reduction in the collectable

rents and, second, due to the reduction in residents' disposable income), the sales tax is considered a better option under the absence of externalities.

The changes in municipal perceived marginal costs are more pronounced in the presence of externalities. Both cross-border shopping and commuting affect the absolute positions of the marginal cost components, overall increasing or decreasing them for the same ranges of the publicly provided good. The use of the sales tax under cross-border shopping generates tougher competition, in which the tax rate matching strategy may be employed or the tax may even be abandoned. On the contrary, the adoption of the payroll tax results in reduced competition under commuting because of benefits to both interacting jurisdictions. Given these findings, the local payroll tax should be recommended to municipalities as a better choice in a world with mobility.

The model has the potential to explain a number of seemingly different empirical findings, including different kinds of tax interactions (i.e. rate-increasing/reducing competition or no relationship) and commonly observed tax phenomenon (i.e. adoption of a tax by some municipalities but not by others, rate clustering around a specific tax value).

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3.7. Appendix

Example 1

The basic set up includes standard preferences, $U = h \times x + \ln g$, one existing municipal tax (a uniform property tax for all types of property) and a business capital presence in the municipality.

First, if housing consumption is fixed at $\bar{h}$, the local residents are limited in the consumption of the private good by their constant wage income, $w = (1+p)\bar{h} + x$ or $x^* = w - (1+p)\bar{h}$ ($x_p^* = -\bar{h} < 0$ and any increase in p will tend to reduce x). Substituting the optimal demand functions into the utility function, the indirect utility function is derived, $V = \bar{h} \times x^* + \ln g = \bar{h}(w - (1+p)\bar{h}) + \ln g$.

Second, if the business per capita revenue function is $R = xk - \frac{1}{2}k^2$ and its per capita cost function is $C = \bar{r}k + x + pk$, its profit maximization of $\pi = R - C = xk - \frac{1}{2}k^2 - \bar{r}k - x - pk$ yields $x - k - \bar{r} - p = 0$ or $x - k - p = \bar{r}$. Business property return equalization across the municipalities, $x - k - p = \bar{r} = x' - k' - p'$ (assuming the same functional forms for the business revenue and cost functions, fixed housing $\bar{h}'$ and $x' = w - (1+p')\bar{h}'$ in the other jurisdiction), along with the capital scarcity in the region, $kN + k'N' = \bar{K}$, can be solved for the optimal retail capital in each of the two jurisdictions, $k = \bar{k} + \frac{x - x' + p' - p}{N + N'}N' = \bar{k} + \frac{\bar{h}' - \bar{h} + p'(\bar{h}' + 1) - p(\bar{h} + 1)}{N + N'}N'$ (as wages are the same and cancel out) and $k' = \bar{k} - \frac{x - x' + p' - p}{N + N'}N = \bar{k} - \frac{\bar{h}' - \bar{h} + p'(\bar{h}' + 1) - p(\bar{h} + 1)}{N + N'}N$, where $\bar{k} = \frac{\bar{K}}{N + N'}$ is overall per capita business property investment in the region.

Third, the government maximization of the voters' indirect utility subject to the balanced budget constraint, when the government does not render any services to businesses ($\bar{e} = 0$), implies:

$$L = \bar{h}(w - (1+p)\bar{h}) + \ln g + \mu[p\bar{h} + p(\bar{k} + \frac{\bar{h}' - \bar{h} + p'(\bar{h}' + 1) - p(\bar{h} + 1)}{N + N'}N') - g]$$

$$\frac{\partial L}{\partial p} = \bar{h}(-\bar{h}) + \mu[\bar{h} + \bar{k} + \frac{\bar{h}' - \bar{h} + p'(\bar{h}' + 1) - p(\bar{h} + 1)}{N + N'}N' + p(-\frac{\bar{h} + 1}{N + N'}N') = 0 \qquad \text{(B1)}$$

$$\frac{\partial L}{\partial g} = \frac{1}{g} - \mu = 0. \qquad \text{(B2)}$$

From (B1), (B2) and the government budget constraint, it follows that $\bar{h}^2 p(\bar{h} + \bar{k} + \frac{\bar{h}' - \bar{h} + p'(\bar{h}' + 1) - p(\bar{h} + 1)}{N + N'}N') = \bar{h} + \bar{k} + \frac{\bar{h}' - \bar{h} + p'(\bar{h}' + 1) - p(\bar{h} + 1)}{N + N'}N' - \frac{p(\bar{h} + 1)}{N + N'}N'$ or after

simplification $p=\frac{1}{\bar{h}^{-2}+\frac{\bar{h}+1}{\bar{h}+k}\frac{N'}{N+N'}}$, where $k=\bar{k}+\frac{\bar{h}'-\bar{h}+p'(\bar{h}'+1)-p(\bar{h}+1)}{N+N'}N'$.

Totally differentiating the derived reaction function $\bar{h}^{-2}p(\bar{h}+\bar{k}+\frac{\bar{h}'-\bar{h}+p'(\bar{h}'+1)-p(\bar{h}+1)}{N+N'}N')=\bar{h}+\bar{k}+\frac{\bar{h}'-\bar{h}+p'(\bar{h}'+1)-p(\bar{h}+1)}{N+N'}N'-\frac{p(\bar{h}+1)}{N+N'}N'$ with respect to both tax rates yields a relationship between the property tax rates in both municipalities, $\frac{\partial p}{\partial p'}=\frac{(\bar{h}'+1)(1-\bar{h}^{-2}p)}{\bar{h}^{-2}(\bar{h}+k)\frac{N+N'}{N'}+(\bar{h}+1)(2-\bar{h}^{-2}p)}=\frac{\frac{\bar{h}'+1}{\bar{h}+k}\frac{N'}{N+N'}(1-\bar{h}^{-2}p)}{\bar{h}^{-2}+\frac{\bar{h}+1}{\bar{h}+k}\frac{N'}{N+N'}(2-\bar{h}^{-2}p)}$.

Because $\frac{\bar{h}+1}{\bar{h}+k}\frac{N'}{N+N'}>0$, $\frac{\bar{h}'+1}{\bar{h}+k}\frac{N'}{N+N'}>0$, $p=\frac{1}{\bar{h}^{-2}+\frac{\bar{h}+1}{\bar{h}+k}\frac{N'}{N+N'}}<\frac{1}{\bar{h}^{-2}}$ or $p\bar{h}^{-2}<1$, the slope of the reaction function is positive, or $\frac{\partial p}{\partial p'}>0$.

Such interdependence is consistent with both tax competition (when the jurisdictions are forced to decrease their tax rates as a result of their interdependence) and tax mimicking (when the jurisdictions do not have to reduce their taxes at all and even can choose to increase them). To see if the resultant property tax rate p will be higher or lower in this case, the competitive outcome is compared with the outcome in isolation. In the isolated jurisdiction, the government optimization condition is shown to be $\frac{V_g}{V_w}=\frac{\bar{h}}{\bar{h}+\bar{k}}$, which for the given utility function yields $\frac{\frac{1}{\bar{g}}}{\bar{h}}=\frac{\bar{h}}{\bar{h}+\bar{k}}$ or $\bar{h}^{2}g=\bar{h}+\bar{k}$. If, for simplicity, the per capita business property investment is fixed at $\bar{k}=\frac{\bar{K}}{N+N'}$, then, without the competitive interactions, the municipality in question chooses its property tax rate such that $\bar{h}^{2}p(\bar{h}+\bar{k})=\bar{h}+\bar{k}$ or $p=\frac{1}{\bar{h}^{-2}}$. This is clearly a higher rate than the one chosen under capital mobility, $p=\frac{1}{\bar{h}^{-2}+\frac{\bar{h}+1}{\bar{h}+k}\frac{N'}{N+N'}}$, implying a decrease in the originally selected property tax rate under the competitive pressure to attract/retain business capital within the jurisdiction.

The numerical example in Brueckner and Saavedra (2001) can be shown to produce the same unambiguously positive relationship between the tax rates of the two municipalities once the wage income of the individuals is assumed to be exogenous and constant. This requires a change in the theoretical approach to the municipal economy: instead of modeling the whole production within two jurisdictions with an endogenous

wage (given by $w = f(k) - k\frac{\partial f(k)}{\partial k}$), a method of limited inclusion of only (commercial) property investment as a part of municipal property tax base has to be adopted (justified by an overall production process being incomplete inside of a single municipality and, thus, not enough to determine the wage there). The assumption of an exogenous wage (meaning constant marginal utility of wage income), together with the linear utility function in both consumption variables and the publicly provided good (meaning constant marginal utility from the public output) also alters the shape of the MWTP curve from a downward sloping curve to a straight horizontal line, which qualitatively is not expected to affect the type of municipal interactions.

Example 2

(a) Now, for mathematical simplicity, we adopt the following individual preferences $U = h \times x + g$ in the municipality under consideration (with constant rather than diminishing marginal utility of g). If both consumption goods are allowed to change, the optimal choices are given by $\frac{x}{h} = 1 + p$, which, along with the budget constraint, yields $h^* = \frac{w}{2(1+p)}$, $x^* = \frac{w}{2}$ and indirect utility $V = \frac{w^2}{4(1+p)} + g$. Since both interacting jurisdictions practice uniform residential and business property taxation and their commercial sectors have the same profit functions, $k = \bar{k} + \frac{x - x' + p' - p}{N + N'} N'$ and $k' = \bar{k} - \frac{x - x' + p' - p}{N + N'} N$ as in the example above (where $\bar{k} = \frac{\bar{K}}{N + N'}$ is the per capita amount of business property in the region). Due to the presence of x' in the expression for k, the individual preferences of the neighbour now hold some importance for the business investment choices. These preferences are assumed to be $U' = h'^{\frac{2}{3}} \times x'^{\frac{1}{3}} + g'$, implying $h'^* = \frac{2w}{3(1+p')}$ and $x'^* = \frac{w}{3}$, where p' is the neighbour's single property tax rate. Using the two demand functions for the private retail good, k can be shown to be equal to $k = \bar{k} + \frac{\frac{w}{2} - \frac{w}{3} + p' - p}{N + N'} N' = \bar{k} + \frac{\frac{w}{6} + p' - p}{N + N'} N'$.

Government maximization of the citizens' utility in the first municipality is given by (if $\bar{e} = 0$):

$$L = \frac{w^2}{4(1+p)} + g + \mu[p\frac{w}{2(1+p)} + p(\bar{k} + \frac{\frac{w}{6} + p' - p}{N + N'} N') - g]$$

$$\frac{\partial L}{\partial p} = -\frac{w^2}{4(1+p)^2} + \mu[\frac{w}{2(1+p)^2} + k + p(\frac{-N'}{N + N'})] = 0 \qquad \text{(B3)}$$

$$\frac{\partial L}{\partial g} = 1 - \mu = 0. \qquad \text{(B4)}$$

From (B3) and (B4), the municipal reaction function can be derived as $\frac{w}{2}(\frac{w}{2}-1)=(1+p)^2(k-\frac{pN'}{N+N'})$, where $k=\bar{k}+\frac{\frac{w}{6}+p'-p}{N+N'}N'$. Unfortunately, it is not easy to express the local property tax rate from this exponential function. But its total differentiation with respect to both municipal taxes allows us to express the slope of the reaction function, $\frac{\partial p}{\partial p'}=\frac{(1+p)^2\frac{N'}{N+N'}}{(1+p)^2\frac{2N'}{N+N'}-2(1+p)(k-\frac{pN'}{N+N'})}=\frac{1+p}{2[1+3p-\frac{\bar{K}}{N'}-\frac{w}{6}-p']}$. The local government has to set its single property tax rate to pursue the strategic goals of residential utility maximization (including through the use of rent extraction from the commercial sector), making it difficult to predict the nature of its reaction to changes in the property tax of the other municipality. In fact, it clearly depends on wage income, population size and the total amount of capital investment available in the region (apart from individual preferences). A competitive relationship of the form $\frac{\partial p}{\partial p'}>0$ is expected: 1) if wage income is rather low, or $\frac{w}{6}$ is a small number; 2) if the capital available for business property investment is scarce, so $\bar{K}$ is low; 3) if the neighbouring municipality is densely populated, so N' is large. In all three cases the development of tax competition between the jurisdictions is due to their setting relatively high property tax rates under low wages and then seeking to reduce their taxes to retain scare business capital within their borders.

(b) Now assume a standard utility function of type $U=h\times x+\ln g$ with diminishing marginal utility of g. The optimal individual choices still obey $\frac{x}{h}=1+p$, implying $h^*=\frac{w}{2(1+p)}$ and $x^*=\frac{w}{2}$ as well as $V=\frac{w^2}{4(1+p)}+\ln g$. Also, suppose the other municipality faces the preferences of $U'=h'^{\frac{2}{3}}\times x'^{\frac{1}{3}}+\ln g'$, yielding the following demands: $h'^*=\frac{2w}{3(1+p')}$ and $x'^*=\frac{w}{3}$.

Under the assumptions of uniform property taxation and identical business profit functions, yielding $k=\bar{k}+\frac{\frac{w}{6}+p'-p}{N+N'}N'$, the government maximization problem (if $\bar{e}=0$) is:

$$L=\frac{w^2}{4(1+p)}+\ln g+\mu[p\frac{w}{2(1+p)}+p(\bar{k}+\frac{\frac{w}{6}+p'-p}{N+N'}N')-g]$$

$$\frac{\partial L}{\partial p} = -\frac{w^2}{4(1+p)^2} + \mu[\frac{w}{2(1+p)^2} + k + p(\frac{-N'}{N+N'})] = 0 \qquad \text{(B5)}$$

$$\frac{\partial L}{\partial g} = \frac{1}{g} - \mu = 0. \qquad \text{(B6)}$$

(B5) and (B6) combined generate the municipal reaction function $\frac{w}{2}(\frac{w}{2}p[\frac{w}{2(1+p)} + k] - 1) = (1+p)^2(k - \frac{pN'}{N+N'})$. Again, the local property tax rate cannot be easily expressed from this expression, but its total differentiation with respect to both municipal taxes gives the expression for the slope of the reaction function:

$$\frac{\partial p}{\partial p'} = \frac{\frac{N'}{N+N'}[(1+p)^2 - \frac{w^2}{4}p]}{\frac{w^3}{8(1+p)^2} - [2(1+p) - \frac{w^2}{4}]k + \frac{N'}{N+N'}[2(1+p)^2 + 2(1+p)p - \frac{w^2}{4}p]} =$$

$$= \frac{(1+p)[1+p-\frac{w^2 p}{4(1+p)}]}{\frac{w^3}{8(1+p)^2}\frac{N+N'}{N'} + (1+p)[2(1+2p) - \frac{w^2 p}{4(1+p)}] + (1+p)[\frac{w^2}{4(1+p)} - 2](\frac{\bar{K}}{N'} + \frac{w}{6} + p' - p)}.$$ The numerator can be signed if we keep in mind that without any business capital the municipality sets its tax so that $\frac{w^2}{4(1+p)^2}(\frac{pw}{2(1+p)}) = \frac{w}{2(1+p)^2}$ or $\frac{w^2 p}{4(1+p)} = 1$. Once the source of business capital subsidy to the residential sector becomes available, the common tax rate is expected to decrease to ease the burden on voters, implying $\frac{w^2 p}{4(1+p)} < 1$. Then two terms can be determined to be positive, $1 + p - \frac{w^2 p}{4(1+p)} > 0$ and $2(1+2p) - \frac{w^2 p}{4(1+p)} > 0$. The remaining term in the denominator is negative, $\frac{w^2}{4(1+p)} - 2 < 0$, as $\frac{w^2}{4(1+p)} < \frac{1}{p}$ and $\frac{1}{p} > 1$, and the conditions for rate-reducing tax competition are similar to those in the example above.

(c) Suppose the local government decides to set two different property tax rates – p for residential property and $\tilde{p}$ for commercial property (p' and $\tilde{p}'$, respectively, for the other municipality). This change leaves the individual's optimization unaffected, but modifies the optimal capital functions $k = \bar{k} + \frac{\frac{w}{6} + \tilde{p}' - \tilde{p}}{N+N'}N'$ and $k' = \bar{k} - \frac{\frac{w}{6} + \tilde{p}' - \tilde{p}}{N+N'}N$. Because h and x are unrelated, k is a function of only its own tax rate. The government's maximization with respect to the residential property tax indicates the unresponsiveness of p to changes in p'. At the same time, the government rent-extracting policy ensures

that $\tilde{p}k = \tilde{p}(\bar{k} + \frac{\frac{w}{6} + \tilde{p}' - \tilde{p}}{N+N'}N')$ is maximized in terms of $\tilde{p}$ or $\bar{k} + \frac{\frac{w}{6} + \tilde{p}' - \tilde{p}}{N+N'}N' - \tilde{p}\frac{N'}{N+N'} = 0$. Then $\tilde{p} = \frac{\bar{K}}{2N'} + \frac{\frac{w}{6} + \tilde{p}'}{2}$ and there is a competitive relationship between the business property taxes of both jurisdictions as $\frac{\partial \tilde{p}}{\partial \tilde{p}'} = \frac{1}{2} > 0$. Differentiation between the two types of property proves to be strategically beneficial: first, the need to adjust the residential property tax rate to the capital inflows and outflows is removed; second, the type of interactions in the business property taxes is easier to predict - it is expected to be competitive due to the possible mobility of capital. (Rent maximization by the neighbouring municipality implies a similar reaction function $\tilde{p}' = \frac{\bar{K}}{2N} - \frac{\frac{w}{6} - \tilde{p}}{2}$. Solving both reaction functions yields the equilibrium business property tax rates $\tilde{p}^* = \frac{\bar{K}(2N+N')}{3NN'} + \frac{w}{18}$ and $\tilde{p}^{*\prime} = \frac{\bar{K}(N+2N')}{3NN'} - \frac{w}{18}$. If, in fact, the population in both jurisdictions is the same, $N = N'$, then $\tilde{p}^* = \frac{\bar{K}}{N} + \frac{w}{18}$ and $\tilde{p}^{*\prime} = \frac{\bar{K}}{N} - \frac{w}{18}$, suggesting a higher business property tax in the municipality with the greater demand for the private retail good).

Example 3

Let's examine the case of two municipal taxes if no cross-border shopping is expected to occur. Assume that the municipality under consideration faces the following individual utility function $U = h \times x + g$. Utility maximization by its residents with respect to h and x subject to their budget constraint, $(1+p)h + (1+s)x = w$, yields $h^* = \frac{w}{2(1+p)}$ and $x^* = \frac{w}{2(1+s)}$. The indirect utility function becomes $V = h^* \times x^* + g = \frac{w^2}{4(1+p)(1+s)} + g$.

From the examples above, if the business profit function is $\pi = R - C = xk - \frac{1}{2}k^2 - \bar{r}k - x - \tilde{p}k$, profit maximization with respect to k yields $x - k - \bar{r} - \tilde{p} = 0$ or $x - k - \tilde{p} = \bar{r}$, where $\tilde{p}$ is the business property tax rate and $\bar{r}$ is the rate of return on capital investment. Profit maximization in the other municipality gives $x' - k' - \tilde{p}' = \bar{r}$. The return equalization condition, $x - k - \tilde{p} = x' - k' - \tilde{p}'$, along with the business capital scarcity condition, $kN + k'N' = \bar{K}$ (N & N' are municipal populations), allow us to solve for the optimal business property investment in the municipality,

$k = \bar{k} + \frac{x - x' + \tilde{p}' - \tilde{p}'}{N + N'} N'$, where $\bar{k} = \frac{\bar{K}}{N + N'}$. The individual preferences for h and x in the other municipality look like $U' = h' \times x'^2 + g'$, implying $h^{*\prime} = \frac{w}{3(1+p')}$ and $x^{*\prime} = \frac{2w}{3(1+s')}$.

All this information is incorporated in the government maximization problem:

$$L = \frac{w^2}{4(1+p)(1+s)} + g + \mu[p\frac{w}{2(1+p)} + s\frac{w}{2(1+s)} + \tilde{p}(\bar{k} + \frac{\frac{w}{2(1+s)} - \frac{2w}{3(1+s')} + \tilde{p}' - \tilde{p}}{N + N'} N') - g]$$

$$L_p = -\frac{w^2}{4(1+p)^2(1+s)} + \mu[\frac{w}{2(1+p)} - p\frac{w}{2(1+p)^2}] = 0 \qquad \text{(B7)}$$

$$L_s = -\frac{w^2}{4(1+p)(1+s)^2} + \mu[\frac{w}{2(1+s)} - s\frac{w}{2(1+s)^2} + \tilde{p}(-\frac{w}{2(1+s)^2}\frac{N'}{N+N'})] = 0 \qquad \text{(B8)}$$

$$L_g = 1 - \mu = 0 \qquad \text{(B9)}$$

Combining (B7) and (B9) yields $\frac{w}{2(1+s)} = 1$ or $s^* = \frac{w}{2} - 1$, the optimal sales tax rate before any competition. Combining (B8) and (B9) yields the sales tax reaction function $\frac{w}{2(1+p)} = 1 - \frac{\tilde{p}N'}{N+N'}$. Now, remembering that the government also extracts rents from the business sector, $\tilde{p}(\bar{k} + \frac{x - x' + \tilde{p}' - \tilde{p}}{N+N'} N')$ is maximized with respect to $\tilde{p}$. Then

$\bar{k} + \frac{x - x' + \tilde{p}' - \tilde{p}}{N+N'} N' + \tilde{p}(\frac{-N'}{N+N'}) = 0$ or $\bar{k} + \frac{x - x' + \tilde{p}'}{N+N'} N' - 2\tilde{p}\frac{N'}{N+N'} = 0$ and

$$\tilde{p} = \frac{\bar{k}\frac{N+N'}{N'} + x - x' + \tilde{p}'}{2} = \frac{\frac{\bar{K}}{N'} + \frac{w}{2(1+s)} - \frac{2w}{3(1+s')} + \tilde{p}'}{2}.$$

There are no expected interactions in property taxes since h and x are not related. Substituting $\tilde{p} = \frac{\frac{\bar{K}}{N'} + \frac{w}{2(1+s)} - \frac{2w}{3(1+s')} + \tilde{p}'}{2}$ into the equation $\frac{w}{2(1+p)} = 1 - \frac{\tilde{p}N'}{N+N'}$, the municipal reaction to its neighbour's sales tax can be derived as

$$\frac{w}{2(1+p)} = 1 - \frac{\frac{\bar{K}}{N'} + \frac{w}{2(1+s)} - \frac{2w}{3(1+s')} + \tilde{p}'}{2}\frac{N'}{N+N'}$$ or

$$s = \frac{w}{2}\frac{1}{(2 - \frac{w}{(1+p)})\frac{N+N'}{N'} - \frac{\bar{K}}{N'} + \frac{2w}{3(1+s')} - \tilde{p}'} - 1.$$ Clearly,

$$\frac{\partial s}{\partial s'}=-\frac{\frac{w}{2}}{[(2-\frac{w}{(1+p)})\frac{N+N'}{N'}-\frac{\bar{K}}{N'}+\frac{2w}{3(1+s')}-\tilde{p}']^2}\times(-\frac{2w}{3(1+s')^2})>0,$$ despite the asymmetry in individual preferences. Still, compared with the optimal sales tax before tax competition, $s^*=\frac{w}{2}-1$, the new tax expression $s=\frac{w}{2}\frac{1}{(2-\frac{w}{(1+p)})\frac{N+N'}{N'}-\frac{\bar{K}}{N'}+\frac{2w}{3(1+s')}-\tilde{p}'}-1$ implies that the sales tax is likely to go down (as $(2-\frac{w}{(1+p)})\frac{N+N'}{N'}-\frac{\bar{K}}{N'}+\frac{2w}{3(1+s')}-\tilde{p}'$ is expected to be larger than 1), indicating tax competition in municipal sales taxes.

Example 4

Consider the case of two municipalities with payroll and property taxes and no commuting. Assume that one of the municipalities faces the individual utility function $U=h\times x+g$ (under homogeneous population, no distinction is necessary between the average and median citizens). Residents' utility maximization with respect to h and x subject to their budget constraint, $(1+p)h+x=(1-t)w$, yields $h^*=\frac{(1-t)w}{2(1+p)}$ and $x^*=\frac{(1-t)w}{2}$. The indirect utility function is $V=h^*\times x^*+g=\frac{(1-t)^2w^2}{4(1+p)}+g$.

Business profit maximization of $\pi=R-C=xk-\frac{1}{2}k^2-\bar{r}k-x-\tilde{p}k$ with respect to k yields $x-k-\bar{r}-\tilde{p}=0$ or $x-k-\tilde{p}=\bar{r}$. If the same profit function is assumed for the businesses in the other municipality, $x'-k'-\tilde{p}'=\bar{r}$. The return equalization condition implies $x-k-\tilde{p}=x'-k'-\tilde{p}'$, and the business capital scarcity condition, $kN+k'N'=\bar{K}$, links taxes in both municipalities through capital investment, $k=\bar{k}+\frac{x-x'+\tilde{p}'-\tilde{p}}{N+N'}N'$, where $\bar{k}=\frac{\bar{K}}{N+N'}$.

Government maximization (without defining the preferences in the neighbouring municipality) gives:

$$L=\frac{(1-t)^2w^2}{4(1+p)}+g+\mu[p\frac{(1-t)w}{2(1+p)}+tw+\tilde{p}(\bar{k}+\frac{\frac{(1-t)w}{2}-x'+\tilde{p}'-\tilde{p}'}{N+N'}N')-g]$$

$$L_p=-\frac{(1-t)^2w^2}{4(1+p)^2}+\mu[\frac{(1-t)w}{2(1+p)^2}]=0 \qquad \text{(B10)}$$

$$L_t = -\frac{2(1-t)w^2}{4(1+p)} + \mu[-\frac{pw}{2(1+p)} + w - \tilde{p}\frac{N'}{N+N'}\frac{w}{2}] = 0 \qquad \text{(B11)}$$

$$L_g = 1-\mu = 0. \qquad \text{(B12)}$$

Combining (B10) and (B11) allows us to derive the optimal payroll tax rate, $\frac{(1-t)w}{2} = 1$ or $t^* = 1-\frac{2}{w}$. Combining (B11) and (B12) produces the optimal property tax $p^* = \frac{(1-t)w-2+\frac{\tilde{p}N'}{N+N'}}{1-\frac{\tilde{p}N'}{N+N'}}$ or $p^* = \frac{\tilde{p}N'}{N+N'-\tilde{p}N'}$ after substituting $t^* = 1-\frac{2}{w}$. Keeping in mind the government rent maximization policy, $\tilde{p}$ is expected to be non-zero. The optimal residential property tax p^* is also positive and the payroll tax no longer dominates the set up (because wage income is exogenous, the payroll tax would act as a lump sum tax in the non-competitive model, making the residential property tax zero). The distortion is induced through the effects of changes in private good consumption on business property investment.

Chapter 4. Municipal Fiscal Behaviour in the Multi-Tax Multi-Jurisdictional Environment of Washington State

4.1. Introduction

The expanding number of theoretical studies of government fiscal interactions has been paralleled by a related empirical literature. The growth of this literature is particularly important for three reasons. First, facing some ambiguity of the theoretical predictions, the empirical studies offer hypothesis testing and estimates of relevant magnitudes. Second, it provides better insight into the environment and conditions behind government behaviour and strategic responses. Third, some of the empirical analysis has started examining new fiscal mechanisms – for example, fiscal constraints such as rate capping and maximum revenue increases that were widely imposed on U.S. local governments in the 1980s and 1990s.

The goal of this chapter is to contribute to several aspects of the growing empirical research. The present study aims to better understand municipal government fiscal behaviour in an environment where a) there is a choice of local taxes, b) there is the potential for inter-municipal tax competition and, c) where fiscal constraints have been imposed. Whereas municipal tax diversification has a relatively long history in many states, municipal tax competition has only received considerable academic attention more recently and municipal fiscal constraints are fairly recent and/or are in the process of frequent changes. These constraints are often imposed either to alleviate the tax burden of a certain group of taxpayers (commonly homeowners) or to limit the extent of tax exporting to non-residents. Despite the widespread existence of such limitation measures in the USA, they have not yet received much attention in the empirical literature that focuses on their impact on municipal fiscal interdependence.

To evaluate municipal fiscal behaviour in a multiple-tax, multi-constraint, multi-jurisdictional environment, a version of the theoretical model developed in the previous chapters is estimated using municipal data from Washington State. In addition to the theoretical factors which follow from the model, behaviour is also assumed to be conditioned by the institutional environment. The estimating strategy can be discussed in the context of the existing empirical work by considering in particular: 1) the nature of government fiscal instrument interactions, 2) the treatment of neighbours and, 3) the estimation method.

4.1.1. The Nature of Government Fiscal Instrument Interactions

Brueckner (2003), in his overview of the empirical studies, divides these studies into "spillover" models and "resource-flow" models. The former category attributes government interdependence to an unavoidable spread of influences, such as information or pollution, known as yardstick competition models and environmental models respectively.[152] The "resource flow" category credits a flow of an economic resource, such as capital, with inducing jurisdictional interactions. This explanation fits most tax competition and expenditure (benefit) competition models. Brueckner points out that the differences between "spillover" and "resource-flow" models are clear only in their theoretical frameworks. Once the estimating equations or government reaction functions are derived, their general specifications appear to be identical for both model categories.

The difficulty of empirically distinguishing between tax competition and other types of interactions prompts some researchers, such as Ladd (1992), Heyndels and Vuchelen (1998) and Revelli (2001, 2002), to not specify the nature of government

[152] Yardstick competition models are represented by Besley and Case (1995) and Bordignon, Cerniglia and Revelli (2003), while environmental models are represented by Fredriksson and Millimet (2002).

interdependence. Instead, they use the term "tax mimicking", which indicates the presence of positive strategic interactions without pinning down their underlying cause. However, many studies argue in favour of competition, following from capital mobility, and later treat any identified strategic behaviour as competitive.[153] Thus, Parys and Verbeke (2007) find evidence of competition in both property and income taxes among Belgian municipalities, Luna (2004) in sales taxes among the counties of Tennessee, Feld and Kirchgässner (2001) in personal income taxes among Swiss cantons and Buettner (2001) in the combined rates of taxes on business earnings and business property taxes, whereas Brett and Pinkse (2000) detect rather limited competition in property taxes in British Columbia.

A few studies choose to conduct a more specific empirical analysis, evaluating the impact of a certain factor on the competitive environment. Brueckner and Saavedra (2001) look into property tax interactions in the Boston metropolitan area before and after Proposition $2\frac{1}{2}$, a tax limitation measure that restricted property tax revenue to 2.5% of the total market value. Initially, they observe strong competitive tax setting behaviour in both residential and business property taxes (facilitated by separate tax rates for different property types). After Proposition $2\frac{1}{2}$ takes full effect, interactions in residential property taxes disappear, but those in business property taxes do not. The authors conclude that the implementation of the tax revenue limitation effectively encouraged readjustments in the mix of property tax revenue sources, with the residential rates staying close to the limit and the business rate dropping below the limit. It is the only

[153] Using French municipal data, Binet (2003) shows that there are no adjustments in fiscal policies, following changes in local population.

study that we are aware of that deals with a fiscal constraint in a multi-jurisdictional environment.[154]

Carlsen, Langset and Rattsø (2005) attempt to relate the degree of firm mobility to the user fee levels of Norwegian municipalities. They use profits as a proxy for mobility: the most profitable industries considered to be the least mobile, and vice versa. Their estimates indicate a positive relationship between the user fees of the jurisdictions and link lower user fees to municipalities with more mobile firms. It is the only study, to the author's knowledge, that employs user charges in a competitive setting.

Finally, Redoano (2007) undertakes the most comprehensive study of European countries with time-series cross section panel data. Before examining the importance of EU membership for the countries' fiscal interactions, the author attempts to resolve the uncertainty about the origin of these interactions. She proposes a simple algorithm to distinguish between different causes of strategic interdependence. In accordance with this algorithm, the presence of positive interactions would require a check for any differences in the coefficients during election years. If they are different, yardstick competition is the most likely cause of behaviour. On the other hand, if the interactions are not different, and a possible common trend is eliminated, positive interactions should be interpreted as tax competition. Her own results indicate yardstick competition among European countries, not so much in income taxes as in expenditure levels.

4.1.2. Treatment of Neighbours

The next important component of the empirical literature involves the definition and weighting of neighbours. Fiscal influences are known to diminish in geographic space,

[154] Dye and McGuire (1997) discuss the changes in fiscal behaviour of the cities and school districts in Illinois before and after a similar limitation measure, but do so without considering competitive interactions.

making distance the most logical criterion for an empirical specification of neighbours. There are typically two ways distances are applied in the existing work: either only closest "common border" neighbours are considered or all neighbours within a certain radius are included. The "common border" definition is used by Brueckner and Saavedra (2001), Luna (2004), Carlsen, Langset and Rattsø (2005), Heyndels and Vuchelen (1998),[155] and Revelli (2001, 2002). Buettner (2001) employs a radius of 30 km for his neighbours, based on the average commuting range in Germany. Both "common border" and radius definitions may be expanded to capture more strategic details. For example, Parys and Verbeke (2007) combine geographic proximity, given by a 15 km radius, with socio-economic proximity, given by similarities in population sizes and expenditure levels. Brett and Pinkse (2000) produce four alternative definitions – economic proximity,[156] "common border", Euclidean (small) distances and population similarity – but find it difficult to justify the use of anything other than economic proximity in the unevenly populated and mountainous British Columbia. The selected specification yields what they call "road neighbours", the nearest jurisdictions connected by roads within a somewhat flexible range of distances.

In the literature, the strategic fiscal parameters of neighbours are averaged or weighted to enter as a single variable in the estimating equation. Ladd (1992), Heyndels and Vuchelen (1998), and Revelli (2001, 2002) favour uniform weights, in which each neighbour is assigned an equal share in the overall effect, whereas Carlsen, Langset and Rattsø (2005), Buettner (2001), Parys and Verbeke (2007) and Brett and Pinkse (2000)

[155] Heyndels and Vuchelen (1998) also employ a second set of neighbours as an extension of their model.
[156] Economic proximity means jurisdictions situated so that individuals tend to view them as substitute locations in which to do business. They narrow this down to jurisdictions directly connected by roads or "road neighbours".

give preference to spatial weights, in which total and individual distances determine the weight of each neighbour's influence. Neither weighting scheme is considered satisfactory due to their following deficiencies: in the absence of trends in the cross section data, uniform weights tend to overstate the influence of some neighbours and to understate the influence of others. On the other hand, spatial weights tend to repeat the distance-dominated definition of neighbours, double emphasizing the same factors. Other weighting schemes that have been used in the literature include population-based weighting, as used in Luna (2004), and the population-and-distance-based weighting in Brueckner and Saavedra (2001). Using data for national governments, Redoano (2007) also introduces, among other weighting schemes, weighting by GDP and volume of trade, variables not available for local governments.[157]

4.1.3. The Estimation Method

The last major component of any empirical strategy is the estimation approach. Most researchers of government fiscal interactions refer to the median voter utility maximization model as the theory behind their empirical analysis. However, even when different authors investigate the same number of strategic fiscal variables, the specification of their estimating equations differs. For example, while considering the interdependence of the choice of a single tax, Brueckner and Saavedra (2001), Carlsen, Langset and Rattsø (2005), Revelli (2001) and Buettner (2001) use a single equation, whereas Luna (2004) and Brett and Pinkse (2000) employ two equations – one for the studied tax rates, another for the tax base – with the neighbours' tax rates entering the

[157] The municipal alternatives can include weighting by personal income, aggregate business assessment etc, conditional on the availability of this data, which is not always the case.

second (auxiliary) equation.[158] At the same time, all the studies include a relatively common set of socio-economic variables as exogenous explanatory variables. These consist of population composition, median or average income, distances from a main hub, area composition and workforce characteristics. The only exception is Buettner (2001) who also introduces a number of lagged expenditure and revenue variables in his regression.

Two studies stand out in an attempt to reflect the more complex strategic behaviour of actual governments. Heyndels and Vuchelen (1998) and Parys and Verbeke (2007) consider the simultaneous determination of property and income taxes in the competitive environment of Belgian municipalities. Both estimate two equations – one for each tax. However, their specifications differ in the extent of interdependence they choose to adopt: for instance, Heyndels and Vuchelen (1998) include own income tax and neighbours' averaged property taxes in their property tax regression, whereas Parys and Verbeke (2007) incorporate both neighbours' averaged property and income taxes, but not own income tax in their property tax equation. It is clear from Heyndels' and Vuchelen's estimates that the impact of a jurisdiction's other tax is always significant (the local taxes tend to be complements). Further, Parys and Verbeke demonstrate that all neighbours' taxes are important determinants of both tax rates. Combined, these results imply that both studies miss a fiscal influence and suggest a line of improvement for any future empirical multiple tax model.

There is less disagreement as to the estimation technique. According to Brueckner (2003), an estimation technique has to address three major econometric issues commonly

[158] Brueckner (2003) encourages the second approach as providing more credibility to tax competition claims.

present under spatial interdependence: 1) endogeneity of some regressors; 2) possible spatial error dependence; and 3) possible correlation between some explanatory variables and the error term. He notes that all three may be resolved by using instrumental variable (IV) or maximum likelihood (ML) estimation methods. In fact, most of the studies referred to above use either IV (two or three stage least squares[159]) or ML to ensure consistent estimates. Only Parys and Verbeke (2007), Redoano (2007) and Revelli (2001) employ to the generalized methods of moments (GMM) approach.

4.1.4. Application in this Study

This chapter is mainly concerned with establishing the presence or absence of strategic government behaviour (fiscal interactions) in a multi-tax environment and whether differences emerge under state imposed fiscal constraints. For this purpose, data on 280 Washington municipalities are collected and analyzed. The choice of Washington State is largely motivated, first, by its relative isolation and, thus, minimal influence from municipalities across state or national borders (Idaho to the east, Oregon to the south and British Columbia to the north), and, second, by the number of tax options available to the municipal governments there. Further, the common practice of rotating elections by the cities in Washington State[160] is likely to diminish the potential for yardstick competition.

The definition of neighbours best suited to Washington municipalities is that of "road neighbours" from Brett and Pinkse (2000). This is in no small part due to the demographic and geographic similarities between Washington State and British Columbia. Since the definition of Brett and Pinkse (2000) is designed to provide a better

[159] Three stage least squares are used only by Heyndels and Vuchelen (1998).
[160] Every year only a fraction of councillors, commonly one third, is elected. For example, this year out of nine councillor seats only three are filled, next year another three and three more a year after that. Then the process is repeated for the first three representatives.

allocation of neighbours under the conditions of uneven population distribution and dividing mountain ranges, it is applied here practically unchanged. However, a new dimension is added by switching to population based weights from spatial weights. Area based, density based and uniform weights are also employed to test the sensitivity of the results to the precise definition of neighbours used. The population based weights are likely to reflect economic development and are preferred to area and number of neighbours based weights as the latter can change arbitrarily.

The equations estimated here differ from those of most other studies in several ways. First, the number of estimated equations is increased from one or two to four in order to reflect the complex simultaneous tax choices of Washington municipalities. One of the four equations explains user fees, which have received little attention in existing empirical work despite their importance to local finances. Second, prompted by the underlying theory, expenditure levels are incorporated in the estimated regression equations, not as lagged variables as in Buettner (2001), but at their current values. Third, and once again in line with the theoretical first order conditions, the multiple tax specification is improved by integrating the approaches of Heyndels and Vuchelen (1998) and Parys and Verbeke (2007) through the parallel inclusion of all own taxes as well as all neighbours' taxes into each regression.

Following Brueckner's suggestion, the regressions are estimated by the IV technique to address potential endogeneity and correlation issues.[161] The 2SLS estimation method is employed since it involves the separate estimation of each tax equation and, as a result, the possible misspecification of one equation will not affect the estimates of any of the

[161] There is a possibility that municipal tax choices may to a certain extent be driven by common shocks. However, due to complexity of the tax model, this study chooses not to address the issue of spatial error dependence. For more detail on the problem, see Saavedra (2003).

other equations. A rather limited use of business taxes by Washington cities introduces a significant asymmetry into one of the equations, making 3SLS estimates more difficult to implement than 2SLS estimates. The 2SLS method also offers another advantage. Municipal business taxes can be further investigated, independently of the other empirical results, to determine motives for their adoption and a change in their responses after the exclusions of numerous non-users.

4.1.5. Organization and Key Results

This chapter is organized as follows. The next section gives an overview of municipal fiscal arrangements in Washington State. The third section lays out a version of the theoretical model developed in earlier chapters, but adapted to more accurately reflect the Washington situation, so as to generate a more appropriate empirical specification. The fourth section provides a brief description of the dataset and definition of the variables. Finally, the last section presents and discusses the empirical findings and states the conclusions.

The key empirical results of the chapter include: 1) the Washington municipalities are found to interact with respect to property taxes both before and after the imposition of the 1% cap on the annual growth of property tax regular levies; 2) the set of new rules for the B&O (i.e. business) taxes is demonstrated to have a strong effect on the strategic behaviour of the B&O tax levying municipalities, reducing their response to their neighbours' B&O taxes; 3) the new rules for B&O taxes are also found to cause the determinants of their existence to differ more from the incentive for their adoption, e.g., while the opportunity to export part of the B&O tax burden to non-residents remains one of the major incentives for B&O adoption, the extent to which it can be carried out is

reduced under the new rules; 4) the lack of a competitive relationship in the utility tax is attributed to the imposition of maximum tax rates on regulated utilities and high rates (compared with other taxes) on unregulated utilities; 5) the study reveals the absence of any interactions in the choice of per capita user fees, instead user fees are employed mostly to accommodate the adverse fiscal impacts of economic expansion as well as in response to the regulation of other taxes; 6) only a few own tax revenue sources are initially found to be substitutable; while greater own tax interdependence in the later year is attributed to both economic growth and tougher tax restrictions; 7) the relationships with the other types of neighbour taxes remain limited in numbers, but are very consistent, with slightly larger coefficient estimates in the later year.

4.2. The Local Public Sector in Washington and Its Finances

4.2.1. Local Functions

Institutionally, the local government structure of Washington is similar to that in most of the other U.S. states, consisting of general purpose districts (incorporated cities/towns[162] and counties) and special purpose districts (school, fire, library districts, etc.). The overall assignment of fiscal powers and functional responsibilities is as follows. First, there are a large number and variety of special purpose districts. Over 1,700 special districts provide local services, but only about 1,400 of these are allowed to levy taxes. Currently, over 70 cities are attached to or jointly operate with fire/library/medical emergency districts.[163] Second, the taxing powers of general purpose districts (counties, cities and towns) are quite broad. Except for the counties, which

[162] Incorporated cities and towns are referred to as municipalities or cities. Unincorporated towns do not have any taxing powers and are served by their respective county governments. They do not have any particular classification in the system.
[163] Association of Washington Cities (2005, p.33).

cannot levy the business and occupation (B&O) tax, they have access to the same three major taxes used by the state government – property, sales and B&O taxes.[164] The use of these taxes, however, is subject to a number of complex rules and restrictions.

The individual special purpose districts are separate local governments responsible for a single function (as is evident from their classification type in Table 4.1). Most of these special districts exist in the unincorporated areas of counties. However, the services of many special purpose districts may be extended to incorporated cities by invitation.[165] Special purpose districts typically have access to a single tax revenue source, usually the property tax. Alternatively, or in addition, they receive state government transfers. The property tax rates of the special districts are capped by state law. For example, the maximum for fire districts is $1.50 per $1,000 of assessed property value and for library districts it is $0.50 per $1,000. In the event of city annexation to one or several of the special purpose districts, the city property tax cap is lowered to reflect the reduced city responsibilities in the new shared functional arrangement.

The general purpose districts are responsible for a wide range of services. They have a number of compulsory basic responsibilities, but commonly choose to provide more than is required by state and federal law. For instance, in addition to public safety (policing, fire protection, justice administration, etc.), street maintenance, water management and general planning, many cities also operate parks, recreation facilities,

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[164] Washington is one of the few U.S. states that does not impose any personal or corporate income taxes. Its B&O tax has a broad tax base - total gross business revenue before deductions for material costs, wages or any other operating expenses - allowing the state government to raise large revenue with low tax rates.
[165] While the special district can serve an incorporated city at the city's invitation, some cities absorb the functions of the special purpose districts by choosing to provide the services themselves.

Table 4.1: Types and Numbers of Taxing Districts in Washington State, 2001-2005*

Taxing district type**	2001	2002	2003	2004	2005
Counties	39	39	39	39	39
Cities and Towns***	279	279	280	280	280
Road	41	39	39	39	39
School	296	296	296	296	296
Public Utility	30	30	30	30	30
Library	16	39	39	39	40
Port	77	76	76	76	76
Water	123	126	124	124	124
Fire	396	394	393	393	393
Sewer	46	39	38	38	38
Metropolitan	2	2	2	2	2
Park	2	2	3	3	3
Flood	1	5	5	5	5
Flood Zone	18	18	18	18	18
Hospital	56	56	56	56	56
Airport	2	2	2	2	2
Cemetery	101	101	101	101	102
Mosquito Control	14	14	15	15	15
Park-Recreation	54	54	54	54	54
Emergency Medical	134	139	139	139	139
Irrigation	2	2	2	2	0
Cultural-Arts	1	1	1	1	1
Agricultural Pest	1	1	1	1	1
Apportionment (urban	2	2	2	2	2
Road Services	1	1	1	1	1
Library (capital improvement)	8	8	8	8	10
Weed	5	5	5	5	5
TOTAL	**1,745**	**1,766**	**1,764**	**1,764**	**1,766**

* http://dor.wa.gov/docs/reports/2005/Property_Tax_Statisctics_2005/Table11.xls

** The table summarizes counties, municipalities and special purpose districts with tax authority only.

*** The City of Twisp, that disappeared from financial records in 2000, is often counted as a municipality bringing the total number to 281

libraries and public transit. The major mandatory and discretionary programs delivered at both the county and city levels are summarized in Table 4.18 of the Appendix. Many of their functions tend to overlap, making close city-county partnership or separation of tasks important for their efficient performance.

4.2.2. Local Finances

To finance their wide-ranging services, the general purpose districts can impose a number of taxes and user fees, collect returns on their investments, receive transfers from senior governments and issue municipal bonds. As can be seen from Tables 4.2 and 4.3, property taxes offer a significant source of revenue, especially for Washington counties where they accounted for 24% of total receipts in 2005. In the case of the cities, property taxes represented only 12% of their 2005 revenues. Sales taxes provided 15% of county revenues in 2005 in contrast to 10% for the cities. City tax sources are more diverse because they have access to the B&O tax that contributed 9% of 2005 revenues. Cities have been gradually increasing their reliance on user fees, from 35% of total receipts in 2001 to 39% in 2005, making these fees the single most significant source of revenues.[166] The user fees of the counties also rose in absolute value, with their share in total receipts ranging between 17% and 19% during 2000-2005. Intergovernmental transfers – state shared revenues, state and federal grants and local shared revenue – contribute considerably more to county finances (21% in 2005) than to cities and are the counties' second largest revenue source after property taxes. The cities derive only 6% of their receipts from intergovernmental transfers.[167]

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[166] Notice that the economic recession of 2001 is accompanied by a large expansion of debt finance from 6% to 18%.

[167] County and city expenditures are presented in Tables 4.19 and 4.20 of the Appendix.

Table 4.2: Total Revenues of All Counties – All Funds, 2000 – 2005*

millions of dollars (and percentages of total revenue)

All Revenues	2000	2001	2002	2003	2004	2005
General Property Taxes	1,013.3 (24%)	1,060.5 (22%)	1,118.1 (21%)	1,139.9 (23%)	1,204.5 (22%)	1,252.2 (24%)
Sales & Use Taxes	597.9 (14%)	658.6 (13%)	677.6 (13%)	678.1 (14%)	721.0 (13%)	790.3 (15%)
Other Local Taxes	163.4 (4%)	165.0 (3%)	174.2 (3%)	183.6 (4%)	210.9 (4%)	238.5 (5%)
Licenses & Permits	53.6 (1%)	58.3 (1%)	60.3 (1%)	72.3 (1%)	83.2 (2%)	87.3 (2%)
Charges & Fees for Services	807.7 (19%)	834.6 (17%)	879.8 (17%)	922.4 (19%)	931.7 (17%)	1,004.0 (19%)
Interest & Investment Earnings	206.3 (5%)	185.2 (4%)	129.2 (2%)	103.1 (2%)	76.9 (1%)	116.2 (2%)
Fines & Forfeits	94.1 (2%)	93.7 (2%)	107.0 (2%)	124.5 (3%)	118.4 (2%)	111.8 (2%)
Rents, Insurance Premiums & Misc.	129.5 (3%)	130.6 (3%)	159.7 (3%)	185.2 (4%)	195.5 (4%)	206.2 (4%)
Intergovernmental Revenues	933.6 (22%)	995.9 (20%)	1,043.5 (20%)	1,055.5 (21%)	1,130.3 (21%)	1,093.9 (21%)
Capital Contributions-Fed/State/Local	--	28.4 (1%)	8.0 (0.1%)	8.6 (0.2%)	12.5 (0.2%)	14.7 (0.3%)
Debt Proceeds**	269.6 (6%)	668.0 (14%)	861.6 (17%)	451.6 (9%)	740.6 (14%)	342.5 (7%)
Grand Total	**4,269.0 (100%)**	**4,878.8 (100%)**	**5,219.0 (100%)**	**4,924.8 (100%)**	**5,425.5 (100%)**	**5,257.6 (100%)**

* Local Government Financial Reporting System (LGFRS), http://www.sao.wa.gov/applications/lgfrs/. Some revenue categories may include only partial data.

** Debt proceeds are funds raised through issuing municipal bonds and other notes and through obtaining intergovernmental loans.

Table 4.3: Total Revenues of All Cities – All Funds, 2000 – 2005*

millions of dollars (and percentages of total revenue)

All Revenues	2000	2001	2002	2003	2004	2005
General Property Taxes	734.7 (12%)	807.3 (10%)	838.2 (11%)	887.6 (11%)	953.5 (12%)	994.2 (12%)
Sales & Use Taxes	693.0 (11%)	715.5 (9%)	709.6 (9%)	712.8 (9%)	763.5 (9%)	821.4 (10%)
Business & Utility Taxes	626.9 (10%)	671.7 (8%)	681.4 (9%)	693.0 (9%)	728.1 (9%)	788.0 (9%)
Other Local Taxes	217.1 (3%)	214.7 (3%)	220.4 (3%)	234.1 (3%)	274.3 (3%)	313.6 (4%)
Licenses & Permits	132.2 (2%)	134.7 (2%)	138.4 (2%)	151.1 (2%)	165.6 (2%)	198.6 (2%)
Charges & Fees for Services	2,448.2 (38%)	2,737.8 (35%)	2,895.2 (37%)	3,030.5 (38%)	3,222.2 (39%)	3,341.5 (39%)
Interest & Investment Earnings	263.6 (4%)	230.6 (3%)	162.2 (2%)	102.7 (1%)	87.6 (1%)	139.3 (2%)
Fines & Forfeits	63.9 (1%)	65.2 (1%)	72.5 (1%)	77.0 (1%)	73.6 (1%)	69.0 (1%)
Rents, Insurance Premiums & Misc.	336.5 (5%)	278.6 (4%)	275.6 (4%)	332.0 (4%)	346.9 (4%)	378.1 (4%)
Intergovernmental Revenues	507.8 (8%)	506.8 (6%)	553.9 (7%)	475.6 (6%)	494.6 (6%)	500.9 (6%)
Capital Contributions-Fed/State/Local	--	145.5 (2%)	189.4 (2%)	147.2 (2%)	174.7 (2%)	288.6 (3%)
Debt Proceeds	360.6 (6%)	1,409.5 (18%)	989.2 (13%)	1,171.0 (15%)	1,000.3 (12%)	638.5 (8%)
Grand Total	**6,384.5 (100%)**	**7,917.9 (100%)**	**7,726.0 (100%)**	**8,014.6 (100%)**	**8,284.9 (100%)**	**8,471.7 (100%)**

* Local Government Financial Reporting System (LGFRS). Some revenue categories may include only partial data.

Washington State has a variety of restrictions on local revenues. The legal restrictions on its cities and counties are atypical in two aspects. First, state limitations on rates and charges date back to the 1970s and are the product of the gradual evolution of the economic and political situation. Many U.S. states did not introduce such restrictions until the early 1990s. Second, the restrictions which include rate caps, maximum allowable increases, conditions for special levies and required revenue sharing, most of these on property taxes, are designed to redistribute, rather than freeze, the tax burden.[168] Both features contribute to the complexity of Washington's municipal fiscal system, making any review of taxation rules impossible outside of the context of the entire local structure.

Property taxes. The property taxes of the cities and towns are applied to the value of all real and personal property.[169] The municipalities share this tax base with the counties, the special purpose districts and the state.[170] Property is reassessed every 2, 3 or 4 years, with the administration of the assessment for all jurisdictions (including the state government) performed by the counties. The property tax rate setting process starts with the municipalities deciding how much revenue they need to raise in property taxes. After the amount is known, the county assessor calculates the resulting rate to be applied (if not overridden by restrictions or other requirements) in dollars per $1,000 of the assessed value.

Municipal property taxes are divided into regular and special tax levies. Most regular levies do not need the approval of the local voters and can be used at a city council's

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[168] See Guppy (2003).
[169] Real property includes land, structures and certain equipment affixed to the structure. Personal property includes machinery, supplies, other moveable items and certain utility property (e.g., dams).
[170] The major difference between the cities/counties/other districts and the state is in the property value used for taxation – assessed value for all local jurisdictions and fair market value for the state.

discretion. They are, however, subject to both a growth limit and a rate cap. Initiative 747 (November 2001) restricted the annual growth rate of property tax revenue derived from regular levies to 1% of the highest amount collected between 1986 and 2001.[171] The 1% cap does not, however, include revenue resulting from new construction, improvements to property and increases in the value of state-assessed property.[172] In fact, newly constructed homes and commercial buildings allow many local governments to generate more revenue than implied by the 1% limit.[173] In addition to the revenue growth limit, cities cannot exceed the maximum rate of $3.375 per $1,000 of the assessed property value or $3.60 if they fund the firemen's pension plan.[174] Further, all local levies combined cannot exceed the maximum rate of $5.90 (where these levies include those covered by the $3.375 or $3.60 limit plus levies for fire protection, libraries, emergency medical services, etc. collected either by special purpose districts to which a city is annexed or by the city itself if it is the service provider). If the levies exceed this limit, they are reduced on a prorated basis according to the state statutory mechanism. If the municipal property tax rate remains within the $3.375 or $3.60 limit, but implies a larger than 1% increase in revenue, the levy is reduced to meet the revenue growth cap.[175] Finally, some regular levies intended for certain programs require a simple majority approval of local voters, but have a limited duration: for example, an affordable housing levy of $0.50 with a time limit of 10 years.

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[171] In fact, the constitutionality of Initiative 747 was challenged in the State Supreme Court and it was ruled unconstitutional late in 2007.

[172] It includes property of transportation and utility companied whose value is assessed by the state.

[173] See Guppy (2003).

[174] See Tax Reference Manuel (2007) of Department of Revenue Washington State.

[175] Property taxes for fire stations, libraries, emergency medical services, etc. collected either by the special purpose districts or directly by the municipalities have only the maximum rate limits and are not subject to the 1% rule.

Under the Initiative 747 restriction on regular levies, municipalities seeking to increase their property tax collection by more than 1% have two options.[176] First, they can draw on their banked capacities (unused full increases in previous years). Second, they can ask their voters to approve a higher increase, known as a levy lid lift. In the case of the latter alternative, a municipal proposal stating the needed increase in property tax revenue and its duration (the exact purpose of the increase does not have to be stated) is voted on by the people and, if approved, overrides the 1% limit. There are no growth rate restrictions on proposed increases. However, the increased collection remains subject to the maximum rate of $3.60. In other words, a city not attached to any fire and/or library district and already charging its citizens the maximum statutory rate cannot request an approval for more property tax revenue. On the other hand, a city attached to a fire and/or library district, even with the maximum statutory rate, can attempt a levy lid lift if its own special purpose districts are not charging the maximum rates. In this case, if an increase is approved, the city ends up collecting more revenue at the special districts' expense (all local property tax levies still have to add up to no more than $5.90).[177] Whenever these districts decide to raise their rates, the city has to relinquish its preemption of their tax room and go back to its statutory maximum of $3.60.

Cities can, however, exceed the $3.60 cap and 1% growth rules (but not the combined $5.90 cap) that apply to regular property tax levies by instituting temporary special levies. Special levies require the approval of voters by a 60% majority and may be used for maintenance and operation (M&O) purposes or bond retirement for capital facilities when authorized by law. Their time duration is limited to 1-4 years for M&O levies and

[176] A third alternative can include switching to the special levies discussed next, but their purpose is restricted by law.
[177] County property tax levies are not included in this limit.

to 20 years for bond levies. At the end of each term, approval can be sought again for new special property tax levies.

The utilization of both regular and special levies by different jurisdictions is summarized in Table 4.4. The cities raise less in regular property levies than the counties, but almost 1.5 times more in special levies, although far less than school districts. Relying on special levies, whenever possible, may be one way for some municipalities to accommodate the long term impact of the 1% limit. In 2002, following the passing of Initiative 747, a number of Washington cities, including Seattle, initially drew upon their property tax banked capacities to generate larger revenue growth, but stabilized their revenue increases in the subsequent years.[178]

Sales taxes. Retail sales and use taxes are charged on most goods and services: the sales tax on those bought within state borders and the use tax on purchases from out-of-state, normally made via catalogs or the Internet. This tax base is shared by the state, counties, cities and special authorities. A common form of special authority is a regional transportation investment district or a transportation benefit district organized by adjacent cities and/or counties. All sales taxes are administered and collected by the state government. Some of these are subject to a flat administrative fee of 1% of the amount gathered on behalf of a local jurisdiction.

The number of local sales tax programs has steadily grown since the tax was initially introduced by Washington cities and counties in 1970 (see Table 4.5). Originally, the cities and counties were allowed to impose a 'basic' rate of 0.5% without voter approval. Later they were also granted up to another 0.5%, 'optional' rate, subject to a local referendum. Almost all cities and counties currently levy both "basic" and

[178] Guppy (2003).

Table 4.4: Property Tax Levies by District, 2006*

(in millions of dollars)

District	Regular Levies	Special Levies
School districts		
State levy	$1,639.9	—
Local M&O levies	—	$1,348.8
Local bond & capital levies	—	$982.2
Counties	$1,198.2	$49.3
Cities and towns	$921.7	$71.2
Special purpose districts		
Fire protection	$331.4	$40.0
Ports	$130.2	—
Libraries	$190.2	$12.2
Hospitals	$54.8	$28.9
Emergency medical service	$159.8	$1.4
Other districts	$37.2	$14.4
TOTAL LEVIES	**$4,663.4**	**$2,548.4**

* Tax Reference Manual' (2007), p.159

"optional" rates. A closer look at the structured fiscal arrangements may explain why. First, cities have to share 15% of their sales tax receipts with their county,[179] so they actually receive an amount equivalent to a 0.85% sales tax rate under the full 1% sales tax, and only an amount equivalent to a 0.425% rate under a 0.5% tax. Second, if the city and its county do not levy the same rate, then the jurisdiction with the higher rate gets 100% of the proceeds in excess of the other government's rate. For example, if a city imposes a 0.5% sales tax, but its county levies a 1% tax, the county receives all the revenue from the optional 0.5% rate for sales within that city plus 15% of the revenue from the city's basic tax. In other words, even if the city's optional sales tax rate is not used, its residents still pay a 1% local sales tax, with the county collecting all the extra

[179] The county gets all of its sales tax revenue in the unincorporated areas.

Table 4.5: Enactment of Local Sales Tax Programs*

DISTRICT/PURPOSE	SALES TAX RATE	YEAR INTRODUCED
Cities and towns**	0.5% basic rate; 0.1-0.5% optional rate	1970; 1982
Counties	0.5% basic rate; 0.1-0.5% optional rate	1970; 1982
Public transit districts**	0.1–0.9%	1971
High capacity transit (RTA)**	0.1-1.0%; 0.4% actually imposed	1990
Criminal justice***	0.1%	1990
Public facilities	0.2%	1991
Food/beverage	0.5%; only King County	1995
Juvenile correctional facilities	0.1%	1995
Zoo/aquarium	0.1%; only Pierce County	1999
Emergency communications***	0.1%	2002
Regional transportation	0.5%	2002
Public safety***	0.3%	2003
Passenger ferries	0.4%	2003
Transportation benefit districts	0.2%	2005
Mental health/chemical dependency	0.1%	2005
Baseball stadium****	0.017%; only King County	1995
Football stadium****	0.016%; only King County	1997
Rural counties****	0.08%	1997
Regional centers****	0.033%	1999

* 'Tax Reference Manual 2007', p.18. Three new programs were added in 2006: hospital benefit (up to 6.5% sales tax rate), local infrastructure financing (up to 6.5%), and municipal services for annexation (0.2%). All three charges are credited against the state sales tax.

** charges may be imposed by the cities.

*** charges may be shared with the cities by their counties.

**** charges are credited against the state sales tax; no additional tax for purchasers.

revenue. This creates a strong incentive for counties to set their sales tax rate to 1% in the hope of cashing in on the municipal revenues within their borders, and for cities to match their county's sales tax rate. The evidence concurs: all the cities that chose not to impose the optional portion of the sales tax – Asotin, Clarkston, Bingen, White Salmon and Stevenson – are located in counties which only levy the basic sales tax rate – Asotin,

Klickitat and Skamania; three more cities with a 0.3% optional rate – Camas, Vancouver and Battle Ground – are within Clark county that also levies an optional sales tax at 0.3%.[180]

With the introduction of the optional 0.5% sales tax rate for local governments, concerns were raised about wide variations in sales tax revenues across local governments. The same year the state government responded by launching an equalization program "to help mitigate the adverse impact of the sales tax for cities and counties with low per capita receipts".[181] The program was funded by the state motor vehicle excise tax and came to an end in January 2000 with the repeal of this state tax. The last "back-fill" equalization payments were made in 2002. By 2005, the effect of the program's cancellation on cities is expected to be well established.

Out of 17 other sales tax types (listed in Table 4.5), the municipalities have direct access to only two. If they operate public transit systems, the cities (along with the counties and transportation authorities) are allowed to impose a sales tax of 0.1-0.9% to finance public transit and an additional sales tax of 0.1-1.0% to finance high capacity transit. The maximum on the second program is reduced to 0.9% if the county levies a sales tax of 0.1% for criminal justice. Both programs require the approval of a simple majority of voters (50% majority vote). These programs remain little utilized at the municipal level, with only two cities levying the public transit surcharge and none levying the high capacity transit surcharge in 2005.

There are also three sales tax programs from which the municipalities can benefit indirectly. The receipts collected by the counties for criminal justice, emergency

[180] All three counties are on the border with Oregon State that does not have any sales tax.
[181] 'Tax Reference Manual 2007', p.47.

communications and public safety programs are shared with the cities on a per capita basis. Around 90% of the revenue from a 0.1% criminal justice tax levied by a county must be apportioned between the county and its cities. Although the tax requires referendum approval (with a 60% majority), it is currently imposed by 32 of 39 counties. Unlike the criminal justice tax, the emergency communications and public safety programs are fairly recent and need only a 50% majority vote for their implementation. At a county's discretion, some of the revenues from a 0.1% emergency communications tax may be shared with its municipalities. In the case of the 0.3% public safety tax, the county is obligated to transfer 40% of its receipts to the cities. So far, both have met with rather limited use: in 2005 only six counties imposed the emergency communications charge and only three counties imposed the public safety charge.[182]

Business taxes. Municipal business taxes consist of general business taxes and utility taxes. General business taxes are always divided into the local B&O tax and other local business taxes. The B&O tax is charged on gross business receipts or gross income, but the local tax base may differ from the base used by the state government (the counties are not allowed to levy this tax).[183] The tax bases of the other business taxes are not uniform and differ across municipalities. They often include business licenses based on activity type, number of employees and even floor space of buildings. Similarly, part of the utility tax base overlaps with that of the state public utility tax that is collected on energy, water and sewer. However, taxes on other utilities, such as telephone, garbage, storm drainage, etc. remain available to, and at the discretion of, each municipality, although

[182] These numbers went up respectively to 9 and 4 in 2006.

[183] The B&O is charged on the total business revenue whereas the sales tax is charged on the part of the revenue derived from the sales of non-exempt items. The sales tax is shifted onto consumers by adding it to the final price, the B&O tax cannot be directly passed onto consumers and is paid by businesses.

they are subject to state limits as discussed below. Both general business taxes and utility taxes are collected and administered by city finance departments.

The state government regulates the local B&O tax in several ways. First, the maximum rate for the local B&O tax is set at 0.2%. Exceptions are made for the municipalities that levied this tax prior to January 1982 at a higher rate. Their rates do not have to be reduced (they are "grandfathered"), but their future rate increases are restricted to 10% (i.e. to a total rate of 0.22%) and annual rate increases to 2% (i.e. 0.004% per year). A city can exceed all these limits if authorized by local voters. Second, the state is compiling a model ordinance to make the B&O tax base more uniform across cities.[184] In 2003, B&O tax levying cities were required to unify their general B&O tax base definitions, such as consistent multiple activities tax credits, exemption of businesses with annual revenue under $20,000, etc. In the study by Yates (2005) of the potential fiscal impact of the model ordinance, these changes alone are found to impose revenue losses on the B&O tax community. Starting in 2008, the uniform income allocation and apportionment rules for production and services mark the second stage of the model ordinance introduction. Yates (2005) predicts further considerable revenue losses to all B&O tax municipalities due to the elimination of B&O tax exporting opportunities by these new provisions. There have been no attempts to standardize the other business tax bases, which remain practically unregulated.

In 2005, only 40 cities imposed the B&O tax, all of them located in Western Washington. Like the state government, they differentiated their rates based on the type of business activity taxed: retail, wholesale, manufacturing and services. Most imposed the B&O tax on all four business activities, but some cities selected one or two activity

[184] This is being done in cooperation with the Association of Washington Cities (AWC).

types for B&O taxation. Table 4.6 shows the number of taxing jurisdictions and their average rates in each category. Five municipalities – Aberdeen, Bellingham, Black Diamond, Tacoma and Westport – had their tax rates grandfathered, whereas Seattle obtained voter approval to increase its rates to 2.15% on retail, wholesale and manufacturing firms and to 4.15% on service firms. State law specifies that the B&O tax cannot be passed directly onto consumers. This provision, along with no allowance for business profitability, is believed to contribute to the unpopularity of the tax and, consequently, to its low level of utilization.[185]

Table 4.6: B&O Rates on Activity Types and Number of Levying Cities, 2005*

TYPE OF BUSINESS ACTIVITY	NUMBER OF CITIES	AVERAGE TAX RATE
Retail businesses	37	0.164%
Wholesale businesses	38	0.158%
Manufacturing firms	39	0.156%
Service firms	37	0.204%

* 'Tax Reference Manual 2007', p.115.

The other business taxes are actually classified as business licenses. This approach has two major implications for the municipal fiscal system. First, businesses paying B&O taxes may also pay business license fees. Second, more cities opt for business licenses instead of the unpopular B&O tax.[186] At least 185 cities levied some kind of business licenses in 2005. Many of these were fixed annual fees. Around 56 municipalities used a fixed dollar amount plus a graduated fee based on the number of a

[185] City of Lynnwood (2005), p. 58.
[186] It is difficult to compare B&O tax and business licence revenue generating capacities as the municipalities with B&O taxes may choose to impose lower business license fees. However, several cities, such as Lake Forest Park, Roy and Ruston, manage to raise more funds through business licensing than B&O taxes.

firm's employees. Finally, two cities – Anacortes and Bothell –incorporated the square footage of business premises into their license fee determination formula.

Many types of utility taxes are also subject to state regulation. The statutory maximum rate on electrical, natural gas, steam energy and telephone utilities is 6% of gross business receipts. The municipalities levying higher rates prior to April 1982 were required to reduce their rates over a ten-year period. Still, the 6% maximum can be exceeded if higher rates are approved by local voters. On the contrary, there are no limits on the rates for garbage, water and sewer services. Over 200 cities taxed at least one type of utility in 2005. Most cities went with the statutory maximum rate, but several obtained voter approval for higher rates. The average utility rate for regulated utility types remained fairly close to 6%, the maximum allowed, but was around 8% for unregulated types (see Table 4.7).

4.2.3. Choice of Tax Variables

The choice of the taxes to be incorporated in the subsequent empirical analysis is motivated by the revenue productivity and flexibility in revenue generation of each tax. In 2005, the taxes discussed above – property, sales, business and utility taxes – jointly make up 31% of total municipal revenue, while user fees are responsible for 39% (see Table 4.3 above). The majority of the tax receipts from these four revenue sources can be used at municipal discretion, with the exception of special levies on property and sales taxes imposed to fund designated special programs. The state government also gives the municipalities a free hand in determining user fees and allocating their proceeds.

There are a number of other taxes that Washington municipalities are allowed to levy: the hotel/motel tax, the real estate excise tax, the timber harvest tax, the gambling tax and

Table 4.7: Average Utility Tax Rates and Number of Levying Cities, 2005*

TYPE OF UTILITY	AVERAGE TAX RATE	NUMBER OF CITIES
Natural gas	5.72%	147
Electric	5.68%	205
Telephone	5.77%	205
Cellular telephone	5.91%	173
Pagers	5.70%	87
Garbage	7.62%	152
Water	8.29%	159
Sewer	8.19%	148
Storm drainage	7.10%	55
Cable television	5.40%	131

* 'Tax Reference Manual 2007', p.116.

the leasehold excise tax. Collectively these account for 4% of total municipal revenue (see Table 4.3), while the funds generated by these taxes are often restricted to certain programs (e.g., hotel/motel tax proceeds must be allocated to tourism purposes, gambling tax proceeds must be allocated to the law enforcement of gambling activities, a portion of real estate excise tax proceeds must be allocated to specific capital projects etc.) Given their small size and limited use, these taxes are excluded from further consideration.

4.3. The Model

The overall local fiscal arrangements of Washington State have a number of important implications for modeling municipal choices of major taxes. First, restrictions on property, B&O and utility taxes leave some room for municipal discretion in selecting tax rates (as there are override mechanisms that can be used if needed). The same assumption is implicitly made by Brueckner and Saavedra (2001) in their study of the effect of a similar property tax limitation measure on the cities of the Boston metropolitan area in Massachusetts. They choose not to alter their theoretical model and resulting

empirical specification before and after the introduction of the annual 2.5% tax revenue cap, but do expect differences in the strength of municipal interactions. Second, with municipal sales tax rates tied to county rates, municipal choices are no longer independent. The strategic picture is also characterized by the absence of cross-border sales tax rate differentials, as 272 out of 280 Washington cities already levy the statutory maximum of 1%. Third, since B&O taxes cannot be passed onto consumers directly, these taxes are expected to be paid by businesses. Because no such provision exists for utility taxes, they are assumed to be entirely borne by local residents.[187] These details are incorporated in a simple theoretical model used here to develop a general empirical specification for the municipal tax reaction functions.

A median voter in any given jurisdiction is assumed to have a utility function $U = U(h, x, u, g, z)$, where h is housing consumption, x is consumption of a private good, u is utility services, g is the per capita provision of a public good with private characteristics (with the quantity provided chosen by the municipality) and z is a set of exogenous (control) variables that represent taste differences across individuals. The median voter maximizes his/her utility subject to a personal budget constraint $(1+p)h + (1+\bar{s})x + (1+t)u + ig = y + \varphi(G)$, where p is the property tax rate, $\bar{s}$ is the sales tax rate, which is set to match the county's rate and so is not a choice variable of the city (that is, it is exogenous), t is the utility tax rate, i is a user fee, y is income and $\varphi(G)$ is some function of the per capita level of grants from higher levels of governments, $0 < \varphi(G) < G$.[188] For simplicity, all prices are normalized to 1 and user

[187] These are the assumptions made to simplify the model settings as the fact who pays the tax cannot determine the tax incidences.
[188] Taxes paid to and services provided by other government levels are not included in the model.

fees are modeled as mandatory flat rate charges levied on a typical resident (since both i and g are determined by the municipal government, the resident simply faces a fixed charge of ig).[189] This is not inconsistent with the reality of many municipalities as they derive a good part of their user fee revenue from fixed fees such as garbage charges, water delivery charges, cable franchise charges, etc.

Such inclusion of G in the individual budget constraint follows the public finance literature on the effects of federal/state grants on local government expenditure. They are known to be subject to complete or partial fiscal illusion, when unobserved or not fully observed grant revenues lower the voter perceived cost of municipal services, providing a city with an incentive to expand them. If voters are assumed to be aware of a portion of the grants $\varphi(G)$ (that is, to have partial fiscal illusion), their municipal government would feel compelled to reduce taxes by the corresponding amount, thus augmenting each voter's income. This leaves the rest of the grants $G-\varphi(G)$ to be used for direct municipal expenditure increases, allowing for both flypaper effect of unconditional grants[190] and implications of conditions on intergovernmental transfers.

Letting the median voter choose h, x and u to maximize their utility function subject to their budget constraint, taking p, $\bar{s}$, t, i, g, G, z and y as exogenous, yields the personal demand functions for housing, the private good and utility services: $h = h(p,\bar{s},t,i,y,g,G,z)$, $x = x(p,\bar{s},t,i,y,g,G,z)$ and $u = u(p,\bar{s},t,i,y,g,G,z)$. Substitution of these functions into the utility function gives the indirect utility function:

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[189] User fees based on the quantity consumed of a publicly provided good are ignored to keep the model simple as they would require an additional measure for public service provision.

[190] The flypaper effect is an increase in local public expenditure, following an increase in federal/state grants, by more than the share of government spending in total spending. See Deller and Maher (2005).

$V = V(p,\bar{s},t,i,y,g,G,z)$. For subsequent estimation, G is separated from y based on the empirical evidence of fiscal illusion showing that grants are generally treated differently than income.[191]

The municipal government budget constraint is $ph + \bar{s}x + tu + ig + bR + G - \varphi(G) = g$, where b is the B&O tax rate on per capita gross business (retail) revenue R. No borrowing is allowed due to classification issues with municipal debt payments. The B&O taxes are considered to be paid by foreign-owned businesses (that is, bR is a transfer from outside-the-city owners of firms to local citizens), with the private good prices unaffected by business taxation. Assuming for simplicity that b is the only tax the local retail sector has to pay, its per capita capital investment k is chosen to maximize own per capita profits $\pi = (1-b)R - \bar{r}k - \theta x$, where its gross revenue is a function of capital and sales, $R = R(k,x)$, $\bar{r}$ is equalized across jurisdictions and, thus is a fixed rate of return on its investment and θ is a wholesale price, $\theta < 1$. Profit maximization implies $(1-b)R_k = \bar{r}$ or $k = k(b,x,\bar{r}) = k(b,p,\bar{s},t,i,y,g,G,z,\bar{r})$ and so $R = R(b,p,\bar{s},t,i,y,g,G,z,\bar{r})$.

The election minded municipal government chooses p, t, i, b and g to maximize the indirect utility of the median voter subject to the municipal budget constraint and the expression for R derived above as well as the median voter demand functions for h, x and u:

$$L = V(p,\bar{s},t,i,y,g,G,z) + \mu[ph(p,\bar{s},t,i,y,g,G,z) + \bar{s}x(p,\bar{s},t,i,y,g,G,z) + tu(p,\bar{s},t,i,y,g,G,z) + ig + bR(b,p,\bar{s},t,i,y,g,G,z,\bar{r}) + G - \varphi(G) - g]$$

[191] See Mitias and Turnbull (2001).

$$\frac{\partial L}{\partial p} = V_p + \mu[h + ph_p + \bar{s}x_p + tu_p + bR_p] = 0 \rightarrow$$

$$p = p(\bar{s}, t, i, b, y, g, G, \mu, z, \bar{r}) \qquad (1)$$

$$\frac{\partial L}{\partial t} = V_t + \mu[ph_t + \bar{s}x_t + u + tu_t + bR_t] = 0 \rightarrow$$

$$t = t(p, \bar{s}, i, b, y, g, G, \mu, z, \bar{r}) \qquad (2)$$

$$\frac{\partial L}{\partial i} = V_i + \mu[ph_i + \bar{s}x_i + tu_i + g + bR_i] = 0 \rightarrow$$

$$i = i(p, \bar{s}, t, b, y, g, G, \mu, z, \bar{r}) \qquad (3)$$

$$\frac{\partial L}{\partial b} = \mu[R + bR_b] = 0 \rightarrow$$

$$b = b(p, \bar{s}, t, i, y, g, G, \mu, z, \bar{r}) \qquad (4)$$

$$\frac{\partial L}{\partial g} = V_g + \mu[ph_g + \bar{s}x_g + tu_g + i + bR_g - 1] = 0 \rightarrow$$

$$g = g(p, \bar{s}, t, i, b, y, G, \mu, z, \bar{r}). \qquad (5)$$

Equations (1)-(4) denote the municipal tax responses. Since no equation is to be estimated for the municipal expenditure level, equation (5) is used to solve for the Lagrange multiplier, $\mu = \mu(p, \bar{s}, t, i, b, y, g, G, z, \bar{r})$. This expression is then used to substitute for the Lagrange multiplier in equations (1)-(4). Proceeding to explicitly solve the derived first order conditions, (1)-(4), eliminates the choice variables from each of the tax equations and, thus, from the empirical estimating equations. Keeping the FOCs in the "reaction function" form, as written above, retains all the strategic tax choice variables in each of the tax equations.

The neighbours' variables are introduced into the above tax response functions by using the conditions for capital return equalization and capital scarcity. Following the methodology used above, the maximization of profit, $\pi' = (1-b')R' - \bar{r}k' - \theta'x'$, by the local retail businesses in the neighbouring municipality leads to $(1-b')R'_{k'} = \bar{r}$ and to

$$k' = k'(b', x', \bar{r}) = k'(b', p', \bar{s}', t', i', y', g', G', z', \bar{r}) \quad (6)$$

(where the apostrophe denotes the neighbour's variables). Using the capital scarcity constraint $kN + k'N' = \bar{K}$, where $\bar{K}$ is the total capital available to both cities and N, N' are jurisdiction populations, per capita retail investment in the neighbouring city can be expressed as $k' = (\bar{K} - kN)/N'$ or

$$k' = k'(k, N, N', \bar{K}) = k'(b, p, \bar{s}, t, i, y, g, G, z, \bar{r}, N, N', \bar{K}) \quad (7)$$

Combining (6) and (7), $k'(b', p', \bar{s}', t', i', y', g', G', z', \bar{r}) = k'(b, p, \bar{s}, t, i, y, g, G, z, \bar{r}, N, N', \bar{K})$, permits us to solve for the rate of return on capital investment, $\bar{r} = \bar{r}(b, p, \bar{s}, t, i, y, g, G, z, b', p', \bar{s}', t', i', y', g', G', z', N, N', \bar{K})$. Finally, if $\bar{r} = \bar{r}(b, p, \bar{s}, t, i, y, g, G, z, b', p', \bar{s}', t', i', y', g', G', z', N, N', \bar{K})$, along with $\mu = \mu(p, \bar{s}, t, i, b, y, g, G, z, \bar{r})$, is substituted into equations (1)-(4), the municipal tax response equations become:

$$p = p(\bar{s}, t, i, b, y, g, G, z, b', p', \bar{s}', t', i', y', g', G', z', N, N', \bar{K}) \quad (8)$$

$$t = t(p, \bar{s}, i, b, y, g, G, z, b', p', \bar{s}', t', i', y', g', G', z', N, N', \bar{K}) \quad (9)$$

$$i = i(p, \bar{s}, t, b, y, g, G, z, b', p', \bar{s}', t', i', y', g', G', z', N, N', \bar{K}) \quad (10)$$

$$b = b(p, \bar{s}, t, i, y, g, G, z, b', p', \bar{s}', t', i', y', g', G', z', N, N', \bar{K}) \quad (11)$$

Before the reaction functions (8)-(11) can be estimated, they must be customized somewhat so that they confirm more closely to the purpose of this study and facilitate estimation. First, to focus exclusively on the neighbour tax effects, as well as to simplify the model, the neighbour variables, y', g', G' and z', are dropped from the estimating regression. Second, since data on total investment capital, $\overline{K}$, is not available (as it is not clearly observed and/or recorded), this variable must also be excluded from the estimating equation. Third, the set of exogenous variables z is assumed to include local characteristics, such as area in square miles, the change in area (compared with the previous year) and the proportions of young and old people. Fourth, the per capita provision of the public good is proxied by per capita municipal expenditure. In order to make the empirical model better reflect the institutional environment of Washington State, this expenditure is spilt into two parts, regular purpose expenditure and special purpose expenditure, to control for variations in city expenditures resulting from differing city-special district divisions of responsibilities.

Most studies on strategic government interactions fail to provide an explicit link between theory and the empirical specification.[192] Brueckner and Saavedra (2001) is one of two exceptions. They assume specific functional forms for utility and capital in order to explicitly derive municipal reaction functions for property taxes. Focusing on a single tax type makes it possible for them to solve their first order condition and retain the neighbour's tax rate in the resulting equation. Brett and Pinkse (2000) is another study that goes into more of the theoretical details behind their empirical work. They also arrive at their empirical specification of the property tax reaction function by

[192] See, for example, Parys and Verbeke (2007), Heyndels and Vuchelen (1998), Luna (2004) and Ladd (1992).

manipulating the first order condition. However, the neighbour taxes enter their main estimating equation through the own property tax base, with the explanatory variables separately specified at the authors' discretion.

4.4. Empirical Analysis

4.4.1. Dataset

The empirical analysis examines tax choices in 280 Washington municipalities for two years, 2001 and 2005. To allow for the role of lagged variables, the dataset includes information from four fiscal years – 2000, 2001, 2004 and 2005.[193] The data come from three different sources: the Local Government Financial Reporting System (LGFRS) provided by the Washington State Auditor's office and the Washington State Office of Financial Management (OFM), both of which collect statistics on all incorporated municipalities on an annual basis, and from the U.S. Census Bureau, which gathers extensive socio-demographic data on incorporated and non-incorporated areas once every ten years.

The LGFRS municipal data are divided into two broad categories: revenues and expenditures.[194] Revenues generally consist of taxes, license fees, user fees, investment earnings, fines, intergovernmental transfers and debt proceeds. The revenue data used in the empirical analysis include data on three types of taxes (the property, sales and business taxes), user fees and intergovernmental transfers. Business taxes can be further broken down into B&O taxes and utility taxes. Intergovernmental transfers are divided into federal and state grants.

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[193] The fiscal year of Washington municipalities coincides with the calendar year.
[194] http://www.sao.wa.gov/applications/lgfrs/.

Expenditures are reported for the major services delivered by the cities: law and justice, fire and emergency services, health and human services, transportation, natural resources, general government, utilities, capital projects and debt payments (principle and interest).[195] Spending on law and justice is one of the major costs for Washington cities. It covers municipal courts and related services (such as detention/correction facilities, legal services, etc.) and law enforcement. Fire and emergency services expenditure is allocated to fire control (prevention and investigation), protective inspection as well as ambulance and rescue services. Expenses on health and human services relate to community development, job placements, welfare and veteran services. These represent a rather small percentage of city expenditure, and are not regularly reported by many municipalities. Due to missing data, health and human services expenditure is omitted from this study. Transportation expenditure is mainly focused on road maintenance and other road services (parking facilities, street lighting, street cleaning, etc). Spending on soil and water conservation, flood and pollution control, drainage and also parks, cultural and recreational activities are grouped under natural resources. General government expenditure includes the costs of some government employees, facilities, data processing, elections, etc. Electric, gas, water, sewer and other utilities present a substantial expense for most cities. Capital expenditures account for 17%-18% of city expenditure. Capital outlays include new construction and major repairs for all categories of municipal expenditures (excluding only road and street construction). Finally, the cities make interest payments on their debts, usually general obligation bonds, and repay debt. Special property tax levies are often used to meet these obligations.

[195] Refer to Table 4.20 in the Appendix for expenditures by category aggregated over of all municipalities.

For the purpose of the empirical analysis, the expenditure categories are aggregated to proxy the provision of local public services in each jurisdiction. Expenditures are aggregated into two variables. One is a "special purpose expenditure" variable consisting of fire/emergency and transportation expenses. This variable is used to control for those situations in which these expenditures (and revenues) are divided in different ways between cities and special purpose districts. The other category is the rest of expenses (excluding health and human programs) which represent "regular purpose expenditure", the level of general services offered by the municipality.[196]

Data on median income and population by age (the old and young age groups) is available from the U.S. Census Bureau only for the year 1999 (from the 2000 census, the last nation-wide census).[197] Since demographic characteristics are not expected to change rapidly, the 2000 census population numbers are used in the empirical estimation.[198] However, the 1999 median income data for each Washington municipality is adjusted, using the growth rates in median income of their respective counties, to generate median income proxies for the years following 1999. For cities with areas in two or three counties, the weighted growth rates are applied, with the weights based on the fraction of the city's population in each county. The data on county median income as well as on municipal total population and area (in square miles) can be obtained from OFM of Washington State[199].

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[196] Regular purpose expenditure includes both interest and principle payments on municipal debt. More consistent estimates, with higher R^2 and lower absolute values of significant coefficients, are obtained by aggregation of expenditure categories in this fashion. This may be due to the issue of debt payment classification for a number of Washngton municipalities. These municipalities failed to report these payments in selected years, but reported higher other expenditures.

[197] http://www.census.gov/.

[198] However, being from 1999, both proportions of young and old are used only as instruments in 2001 and 2005 estimations.

[199] http://www.ofm.wa.gov/economy/hhinc.

The study period is determined by the data, but includes a period of transition in the fiscal systems of Washington municipalities. Over 2002 and 2003, a number of fiscal constraints were imposed on the municipalities. The sales tax equalization program was cancelled in 2000, property tax revenue growth was capped at 1% in 2001 (with this change first applied in the 2002 fiscal year)[200] and the model ordinance for B&O taxes was initiated in 2003 (when the first phase of the model went into effect), forcing new fiscal adjustments on Washington cities. The years 2004 and 2005 can be considered the latest phase in municipal taxation with tougher restrictions and less state government help. As these developments could change municipal behaviour, structural breaks are possible between 2001 and 2005. As a consequence, regressions only for the years 2001 and 2005 are estimated. The results for these two years are compared to establish whether the institutional changes caused differences in municipal strategic tax interactions.

Not all cities could be included in the sample. First, a number of municipalities were deleted due to missing data. Every year several municipalities failed to report to the Washington State Auditor's office (from 9 to 17 for the years surveyed). Some municipalities that did file, left out information on important revenue and/or expenditure variables. Whenever the missing data could not be obtained directly from the city (or other) website or interpolation was not feasible, the municipality was excluded from the sample. Out of 26 such municipalities and towns (listed in Table 4.21 in the Appendix), 21 had a population of under 1,000 people. The two largest excluded municipalities were Wenatchee with 29,320 residents and Ellensburg with 16,700. Because of their relative isolation from other large cities, their exclusion is not expected to distort the results. A

[200] Prior to 2001, a cap allowing for inflation adjustment was in effect.

second reason for the omission of observations results from the application of the neighbour definition. Following Brett and Pinkse (2000), neighbours are defined as "road neighbours, connected by the shortest route between them, not passing through the core of any other jurisdiction".[201] The cities and towns separated by water are considered "road neighbours" if there are regular ferry services available between them.[202] By keeping the maximum distance (radius) under 55 km, one municipality, the City of Forks, is left without a neighbour. Its isolation behind the Olympic Mountains of Washington State results in its exclusion from the sample.[203] Finally, the City of Spokane Valley was incorporated only in 2003.[204] Consequently, 253 observations remain in the dataset for each of the years 2004 and 2005 and 252 for each of the years 2000 and 2001.[205]

4.4.2. Fiscal Constraints and Property Tax Choice Flexibility

Fiscal limitation measures faced by Washington cities could be expected to affect their actual tax choices. However, the extent of the reduction in their tax flexibility would normally depend on how closely the fiscal constraint is generally followed as well as on municipal fiscal circumstances (e.g., banked capacities). As long as most municipal governments select their taxes (well) under the limits, their actions can be perceived as autonomous. In contrast, if the majority of the cities adopt a tax which is at, or essentially at, the upper limit, the flexibility to increase that tax (and, thus, revenue) disappears. Consequently, the looseness of the fiscal constraint becomes necessary for the presence of municipal tax interactions, whereas its tightness implies their absence.

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[201] The neighbours here are not always adjacent, many are separated by unincorporated areas.
[202] There are a couple of cities to the west and north-west of Seattle that rely on ferry routes.
[203] Exclusion of the City of Forks does not change the regression results.
[204] Before 2003, the City of Spokane Valley was considered an unincorporated area. After four attempts to convince its people to incorporate Spokane Valley as a city, the fifth attempt succeeded on March 31, 2003.
[205] There are no amalgamations reported for the studied time periods. Annexations are not uncommon but usually done at the expense of unincorporated areas.

This is expected to be an issue with some taxes due to the maximum rate limits on property taxes (1% allowable revenue growth rate), B&O taxes (0.2% maximum rate) and some of the utility taxes (6% maximum rate).[206]

Brueckner and Saavedra (2001) adopt the same approach to study Proposition $2\frac{1}{2}$, a rate limit on property tax revenue growth in the Boston metropolitan area. The authors claim that if the property tax revenues of most municipalities grow at the maximum rate of 2.5%, their property taxes cease to be a matter of autonomous choice, making the utility maximization problem with its interior tax solutions irrelevant. Their inquiry into actual municipal revenue increases reveals an overwhelming adoption of the maximum limit. Following their logic, more details on the property taxes of the post-constrained Washington municipalities are examined in search of similar evidence in the Washington data.[207]

Additional property tax statistics are available for 2005 and were obtained from the website of the Washington State Department of Revenue.[208] This information includes data on existing property values, current regular levies, the highest prior amount of property taxes collected, the 2004 regular levy, the value of new construction, and growth in state assessed property and annexed property for all 253 jurisdictions. The data are used to calculate the actual increases in municipal property tax revenue in 2005 and to compare these with the maximum allowable increase of 1%. The methodology behind these calculations is summarized in Table 4.22 of the Appendix. The results are presented in Table 4.8 below.

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[206] The utility taxes on electrical, natural gas, steam energy and telephone are capped at 6%. The utility taxes on garbage, water and sewer services and user fees (mostly charged for utilities) remain unregulated.
[207] Since the 1% rule is the most restrictive constraint, all others are assumed to automatically hold, if this holds.
[208] http://dor.wa.gov/Content/AboutUs/StatisticsAndReports/stats_proptaxstats_report.aspx.

Table 4.8: Actual Increases in Regular Property Tax Levies while under the 1% Revenue Cap, 2005

INCREASE DETAIL	NUMBER of JURISDICTIONS
Increases close to 1% (1%±0.25%)	114
Increases greater than 1.25%	21
Increases less than 0.75%	16
Decreases (from -0.005% to -96%)	102
TOTAL	253

Out of the 253 municipalities examined, less than half closely followed the 1% rule in the sense that their increase was outside the range of 0.75% to 1.25%. The distribution of actual tax changes is shown in Figures 4.1 and 4.2. Twenty one cities and towns adopted increases greater than 1.25%. Increases beyond 1% may be accomplished within the rules either by drawing upon their banked capacities of property taxes (total unused increases for the previous years) or, more likely, by getting their voters' approval for levy lid lifts.[209] In turn, 16 municipalities went with far smaller increases between 0% and 0.75%. Finally, 102 jurisdictions chose to decrease their property tax revenue. The distribution of tax decreases is presented in Figure 4.2 (with the three municipalities that chose to reduce their property tax revenue by 57% or more excluded from the figure). With a voter override by either levy lid lifts or special levies always possible, the majority of Washington cities and towns are observed to be only loosely constrained by

[209] The data do not make it possible to distinguish between the two possibilities and no additional information is available on municipal banked capacities. However, Guppy (2003) indicates that a number of cities exhausted their banked capacities during 2002-2003. There is also no data documenting voter approvals.

the 1% rule in 2005. Consequently, there is some basis for allowing property tax (and

Figure 4.1: Distribution Of 1±0.25% Increases in Property Taxes, 2005
(114 Municipalities)

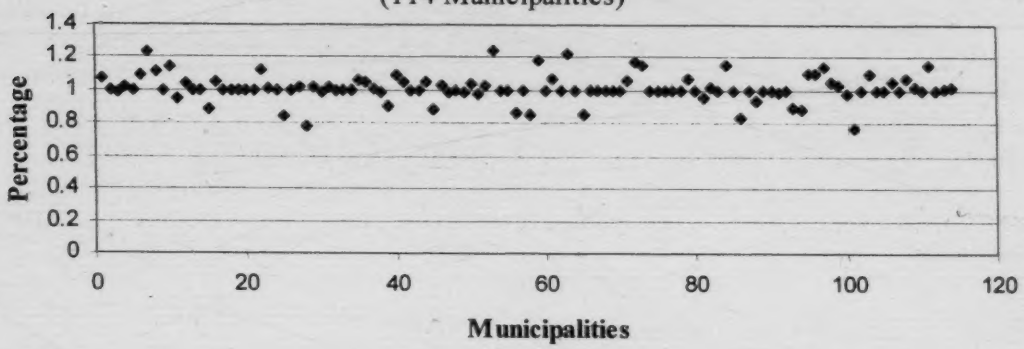
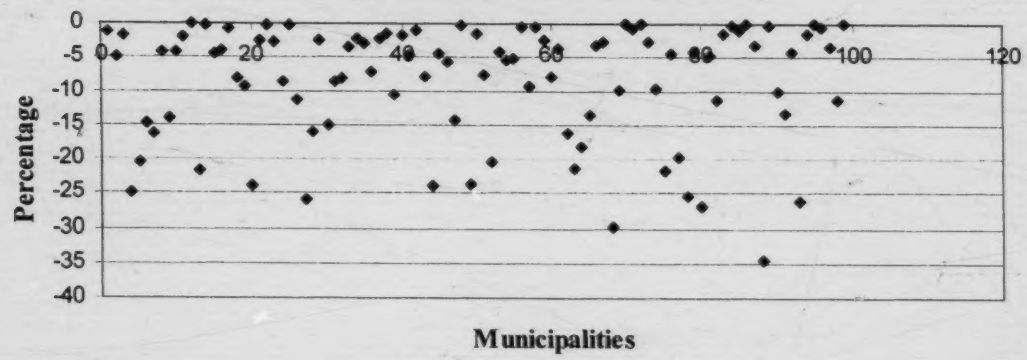


Figure 4.2: Distribution of Decreases in Property Taxes, 2005
(99 Municipalities)



thus revenue) choices to be regarded as autonomous and, thus, that cities have some scope for strategic tax interactions.

4.4.3. Regressions and Variables

Following the theoretical model presented earlier, the discussion of the fiscal constraints and the focus of this study on tax interaction effects, the following empirical specifications are adopted for the municipal reaction functions:

$$PROPT_i = \alpha_1 SALEST_i + \alpha_2 BOT_i + \alpha_3 UTILT_i + \alpha_4 FEES_i + \alpha_5 INCOME_i + \alpha_6 POP_i + \\ + \alpha_7 AREA_i + \alpha_8 FEDAID_i + \alpha_9 STATEAID_i + \alpha_{10} SPECEXPN_i + \alpha_{11} REGEXPN_i + \\ + \alpha_{12} NPROPT_i + \alpha_{13} NSALEST_i + \alpha_{14} NBOT_i + \alpha_{15} NUTILT_i + \alpha_{16} NFEES_i + \alpha_0 + \nu_{1i} \quad (12)$$

$$BOT_i = \beta_1 PROPT_i + \beta_2 SALEST_i + \beta_3 UTILT_i + \beta_4 FEES_i + \beta_5 INCOME_i + \beta_6 POP_i + \\ + \beta_7 AREA_i + \beta_8 FEDAID_i + \beta_9 STATEAID_i + \beta_{10} SPECEXPN_i + \beta_{11} REGEXPN_i + \\ + \beta_{12} NPROPT_i + \beta_{13} NSALEST_i + \beta_{14} NBOT_i + \beta_{15} NUTILT_i + \beta_{16} NFEES_i + \beta_0 + \nu_{2i} \quad (13)$$

$$UTILT_i = \gamma_1 PROPT_i + \gamma_2 SALEST_i + \gamma_3 BOT_i + \gamma_4 FEES_i + \gamma_5 INCOME_i + \gamma_6 POP_i + \\ + \gamma_7 AREA_i + \gamma_8 FEDAID_i + \gamma_9 STATEAID_i + \gamma_{10} SPECEXPN_i + \gamma_{11} REGEXPN_i + \\ + \gamma_{12} NPROPT_i + \gamma_{13} NSALEST_i + \gamma_{14} NBOT_i + \gamma_{15} NUTILT_i + \gamma_{16} NFEES_i + \gamma_0 + \nu_{3i} \quad (14)$$

$$FEES_i = \delta_1 PROPT_i + \delta_2 SALEST_i + \delta_3 BOT_i + \delta_4 UTILT_i + \delta_5 INCOME_i + \delta_6 POP_i + \\ + \delta_7 AREA_i + \delta_8 FEDAID_i + \delta_9 STATEAID_i + \delta_{10} SPECEXPN_i + \delta_{11} REGEXPN_i + \\ + \delta_{12} NPROPT_i + \delta_{13} NSALEST_i + \delta_{14} NBOT_i + \delta_{15} NUTILT_i + \delta_{16} NFEES_i + \delta_0 + \nu_{4i} \quad (15)$$

where: PROPT, SALEST, BOT, UTILT and FEES are property, sales, B&O and utility taxes and user fees, in constant 2005 dollars per capita, respectively, in year i, (corresponding to p, $\bar{s}$, b, t and i in the theoretical model above, with the sales tax rate exogenously tied to the county's sales tax rate and, thus, not being a choice variable); INCOME is median household income for year i (representing y in the model); POP is population in year i (corresponding to N); AREA is occupied area in square miles in year i (a part of z); FEDAID and STATEAID are per capita federal and state grants in year i (together representing G); SPECEXPN is per capita special purpose expenditure – fire/emergency plus transportation expenses – in year i and REGEXPN is per capita regular purpose expenditure – everything else except that in SPECEXPN and health/human expenses – in year i (together representing g); NPROPT, NSALEST, NBOT, NUTILT and NFEES are the weighted averages of neighbours' property, sales, B&O and utility taxes and user fees, respectively, in year i (corresponding to p', $\bar{s}'$, b', t' and i'); the subscript i takes value of either 2001 or 2005.[210]

[210] The subscript j, representing each of the 252 or 253 municipalities, is suppressed for simplicity.

The conventional definition of tax rates as percentage rates, as used by all of the empirical studies mentioned above, is not suitable for the analysis of the tax choices of Washington municipalities. Complexity of their fiscal structure either renders percentage rates meaningless (e.g., for property taxes), or non-representative (e.g., for B&O taxes, utility taxes or user fees).[211] Regular property tax revenue depends upon (prior) existing property, new construction, increases in state owned property and annexed property. With the 1% revenue cap applicable only to existing property, the dynamics in the value of the other property categories widens or narrows the municipal choices of their regular levy rates.[212] These rates are likely to drop if no new construction, annexation or increases in the state owned property value occur, since the existing property assessment tends to go up by more than 1% annually for the majority of the local jurisdictions.[213] However, they may either increase or decrease if new construction, annexation or positive changes in state assessed property are present. For 2005, it is not uncommon to observe any property value addition to local assessment rolls to be accompanied by regular levy rate reductions – for 131 out of 241 cases of new development and for 26 out of 39 cases of annexation.[214] Thus, choosing to employ the percentage or mil rates without accounting for changes in the property tax base may potentially lead to incorrect conclusions.

Tax rates for B&O taxes and for utility taxes need not be representative. B&O tax revenue comes from levies on retail, wholesale, manufacturing and service companies.

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[211] Non-representativeness is due to rates of the same tax being differentiated based on activity type.
[212] The counties are free to adjust (reassess) the property values every two, three or four years, however, their revaluation plans have to receive prior approval from the Washington State Department of Revenue.
[213] Based on detailed property tax statistics from the Washington State Department of Revenue, 178 out of 253 cities experienced a larger than 1% increase in their existing property assessment in 2005.
[214] The value of the state assessed property actually decreased for 135 out of 253 cities in 2005.

Municipal utility tax revenue includes proceeds from electricity, water, gas, sewage, garbage, cable and other utilities. In both instances each activity is taxed at a different rate. As a result, any particular rate cannot be singled out to represent the tax, and it will vary depending upon the composition of base. Also, the tax base for the B&O tax has varied across municipalities. The difficulty is even more evident with the numerous and ever-expanding user fees. To capture both tax base variations and rate differentials within a single tax type, all taxes in the reaction functions are calculated as *tax levels*; that is, as tax revenues per capita. Intuitively, tax levels denote sacrifices in potential consumption made by each local resident in exchange for the publicly provided service. Although this definition of the tax variables modifies the municipal choices in the theoretical model from p, b, t and i to ph, bR, tu and ig, this is not expected to matter since by choosing tax rates in the theoretical model, the city is also choosing tax revenues (as the rates are chosen subject to individual consumption choices).[215]

The four tax levels – PROPT, BOT, UTILT and FEES – are expected to be simultaneously determined. SALEST is excluded from the analysis because it is exogenously tied to the county sales tax and, thus, is not a choice variable. As suggested by the underlying theoretical model, the other taxes are present in each reaction function to allow for their impact on the tax choice. Median income, population, area and per capita federal and state grants – INCOME, POP, AREA, FEDAID and STATEAID respectively – denote the socio-economic and income characteristics of each jurisdiction.

The control variables are considered to be exogenous, with the exception of the median income which is treated as an endogenous variable as in Heyndels and Vuchelen

[215] This is particularly the case with property taxes, as property is assessed before the tax rate is calculated.

(1998).[216] Further, both types of per capita government expenditures, SPECEXPN and REGEXPN, proxy the levels of public services in annexed versus independent cities. These two variables are also expected to be endogenous as tax levels and expenditures are chosen jointly. The endogeneity issue calls for IV estimation. The natural candidates for instruments are the previous year values of the same variables and three additional exogenous characteristics – the change in the occupied area compared with the previous year, CAREA, and the proportions of young and old people in the municipal population, YOUNG and OLD, as determined from the 2000 Census. For comparability, all monetary variables for 2004, 2001 and 2000 are adjusted for inflation, using the Seattle Consumer Price Index with 2005 as the base year.[217] Descriptive statistics for the explanatory variables and the instruments are provided in Tables 4.9 and 4.10 below.

As implied by the theoretical model, the neighbours' averaged tax levels – NPROPT, NSALEST, NBOT, NUTILT and NFEES – enter each regression function to allow for the possibility of interaction of taxes among the municipalities, such as those detected by Parys and Verbeke (2007) using Belgian data. Initially, four different versions of the neighbours' tax levels are computed based on four different weighting schemes. However, weighting by population is considered the most appropriate, as all state and county collected revenue in Washington State is distributed among the municipalities on a population basis. The area based, density based, and uniform weight alternatives are used to check for robustness and sensitivity of the results to the weighting scheme. All

[216] This is in accordance with the Hausman tests conducted for each of those variables.
[217] The Seattle CPI data for the required years is taken from the website of the Washington State Economic and Revenue Forecast Council at http://www.erfc.wa.gov/.

Table 4.9: Descriptive Statistics for 2005, excluding Neighbours (253 observations)

Variable	Details	Mean	Standard deviation	Minimum	Maximum
$PROPT_5$	Property tax level	184.59	115.42	26.25	830.68
$SALEST_5$	Sales tax level	174.94	161.74	20.91	1509.66
BOT_5	B&O tax level	12.41	39.098	0.00	314.73
$UTILT_5$	Utility tax level	95.87	58.74	0.00	284.99
$FEES_5$	Per capita user fees	583.48	437.12	7.56	2658.13
$INCOME_5$	Estimated median income	46155.58	23758.41	15203.31	215719.10
POP_5	Population	14823.83	43841.17	145.00	573000.00
$AREA_5$	Area (in square miles)	6.08	9.94	0.08	83.78
$FEDAID_5$	Per capita federal aid	93.70	288.45	0.00	3724.93
$STATEAID_5$	Per capita state aid	108.05	313.24	-3.06	2956.61
$SPECEXPN_5$	Per capita special purpose expenditure	158.93	107.46	16.93	586.49
$REGEXPN_5$	Per capita regular purpose expenditure	1496.38	1029.23	225.41	7948.68
YOUNG	Proportion of young people 1999	30.29	5.47	17.24	47.79
OLD	Proportion of old people 1999	17.62	6.91	2.45	49.33
$CAREA_5$	Change in area (compared with 2004)	0.03	0.09	-0.11	0.99

Table 4.10: Descriptive Statistics for 2001, excluding Neighbours (252 observations)

Variable	Details	Mean	Standard deviation	Minimum	Maximum
$PROPT_1$	Property tax level	170.74	101.13	23.45	714.48
$SALEST_1$	Sales tax level	162.98	160.34	13.04	1205.01
BOT_1	B&O tax level	11.31	36.23	0.00	265.26
$UTILT_1$	Utility tax level	84.57	58.40	0.00	275.67
$FEES_1$	Per capita user fees	517.09	377.46	0.26	2632.78
$INCOME_1$	Estimated median income	43812.51	20524.39	15531.25	192058.80
POP_1	Population	13920.61	42998.53	150.00	568100.00
$AREA_1$	Area (in square miles)	5.80	9.65	0.08	83.78
$FEDAID_1$	Per capita federal aid	90.99	278.42	-0.01	3631.34
$STATEAID_1$	Per capita state aid	119.78	297.94	-1.12	3951.96
$SPECEXPN_1$	Per capita special purpose expenditure	163.24	118.49	-61.18	876.88
$REGEXPN_1$	Per capita regular purpose expenditure	1408.29	936.79	82.88	8449.88
YOUNG	Proportion of young people 1999	30.29	5.47	17.24	47.79
OLD	Proportion of old people 1999	17.62	6.91	2.45	49.33
$CAREA_1$	Change in area (compared with 2000)	0.08	0.37	-0.07	4.00

weights add to one for the neighbours of each municipality.[218] The weighted values of the tax levels in 2000, 2001 and 2004 are also adjusted for inflation, using the Seattle CPI with 2005 as the base year. As in Heyndels and Vuchelen (1998), the neighbours' explanatory variables are considered to be endogenous and are instrumented using the values from the previous year as instruments (as well as the other instruments noted above).

The existence of the B&O tax in only 15%-16% of the studied jurisdictions raises concerns about an appropriateness of using a linear model of all the observations to model the choice of this tax. To deal with the constrained nature of the dependent variable in the BOT regression, a TOBIT model with the same explanatory variables is specified:

$$\begin{aligned} BOT_i^* &= \lambda_1 PROPT_i + \lambda_2 SALEST_i + \lambda_3 UTILT_i + \lambda_4 FEES_i + \lambda_5 INCOME_i + \lambda_6 POP_i + \\ &+ \lambda_7 AREA_i + \lambda_8 FEDAID_i + \lambda_9 STATEAID_i + \lambda_{10} SPECEXPN_i + \lambda_{11} REGEXPN_i + \\ &+ \lambda_{12} NPROPT_i + \lambda_{13} NSALEST_i + \lambda_{14} NBOT_i + \lambda_{15} NUTILT_i + \lambda_{16} NFEES_i + \lambda_0 + \nu_{5i}, \\ BOT_i &= \begin{cases} BOT_i^* \text{ if } BOT_i^* > 0 \\ 0 \text{ otherwise} \end{cases} \end{aligned} \tag{16}$$

Further, to address the possible sample selection bias of the estimate of the B&O tax equation, a two-step process is employed (as described by Wooldridge (2002, p.567-570)). First a PROBIT model is estimated to determine the probability of adopting this tax. This is then combined with 2SLS estimation of equation (13) using only the smaller sample of B&O tax levying municipalities.

4.4.4. Predictions of the Model

Expectations with respect to the relationships between the municipal tax variables are generally based on the underlying theoretical model. As the theoretical model is too

[218] Other schemes with the weights not adding up to one are also tested. Due to their lower goodness-of-fit measures, their results are not reported here.

complicated to generate qualitative predictions, intuition as well as information on institutions and the data for Washington State are used to form hypotheses about the expected signs of the parameters. The prediction of municipal tax setting behaviour depends upon the "bite" of the tax limitation measures. The seeming looseness of the 1% cap in 2005 supports the presence of competitive interactions in property taxes. It is harder to speculate about property tax interdependence in 2001 as the municipalities faced a similar 4% cap, but no detailed data are available to analyze annual property tax revenue increases. However, the reference by Guppy (2003) to the banked capacities in property taxes accumulated by a number of the Washington cities at that time indicates that the maximum revenue increases allowed were not always used. One possible explanation for staying below the limit is the influence of tax competition.[219]

There are two indications of possible strategic interdependence among the B&O tax levying municipalities. First, B&O tax rates fall on average short of their maximum limit of 0.2%.[220] Second, the cities with B&O taxes are concentrated in Western Washington[221]: 15 of these cities are clustered in the Seattle-Tacoma metropolitan area, 14 more cities are just outside of it and 10 cities are to the South and South-West of Seattle. By imposing B&O tax revenue losses, the introduction of the initial model ordinance requirements between 2003 and 2005 (such as uniform tax definitions, consistent multiple activities tax credits, allocation rules to eliminate multiple taxation, and tax exemptions for businesses with an annual revenue of $20,000 or less) is expected

[219] Another possibility may include simple voter utility maximization by municipal governments. This explanation implies no expectations of any tax interactions.
[220] Higher B&O tax rates only exist in the Cities of Aberdeen, Bellingham, Tacoma and Westport, where they are grandfathered, and in the City of Seattle, where the higher rate was voter approved.
[221] Only one city with a B&O tax, the City of Yakima, is located in the eastern part of Washington State.

to reduce the responsiveness of the own B&O tax to movements in the neighbour B&O tax.

There is unlikely to be significant interaction across cities with respect to tax rates on utility companies. Taxation of the major revenue-yielding activities – telephone and electricity – is regulated by state law and the majority of municipalities have already reached and even, with the voters' approval, exceeded their maximum allowable tax rate limits. The motive to keep utility tax rates high results from the ability of Washington municipalities to export a part of the utility tax burden because they are legally allowed to charge their utility taxes to the citizens of other jurisdictions to whom they are selling utility services.[222]

It is more difficult to form expectations about the likelihood of inter-municipal interactions in municipal user fees. These fees are unconstrained, which makes interaction more likely. Following the initial findings by Carlsen, Langset and Rattsø (2005), tax competition effects on the choice of this tax remains a possibility.

Tax choices (and, thus, the revenue choices) within the same municipality, or *own tax effects*, depend on local characteristics, including consumption preferences, but no clear predictions can be made with respect to these effects.[223] Similar difficulty is encountered with predicting the signs of the interaction effects between the other taxes of the different municipalities, or *neighbour tax effects*. These interaction effects will depend on a combination of local conditions and preferences in the municipality in question and its neighbour(s). As with the own tax effects, the neighbour tax effects may be positive, negative or non-existent. The determination of both is left to the empirical estimates.

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[222] The cities cannot charge utility taxes to the consumers of other jurisdictions if the utility is private.
[223] See the previous chapter for some cases of tax substitutability and complementarity based on consumption preferences.

The expected effects on tax choice of the other independent variables may be summarized as follows. Median income is predicted to be positively correlated with the per capita revenues derived from taxation of normal consumption goods, such as property and utility consumption. This relationship is less straightforward for the B&O taxes levied on the gross revenue of the businesses because increases in income can be not only spent, but also saved. Higher savings and, thus, investment (elsewhere) make higher income earners averse to business taxes, putting pressure on the B&O tax levying municipality to accept a lower B&O tax rate. An additional reduction in B&O taxes with a rise in median income may be caused by a corresponding fall in the proportion of the B&O tax that is exported.[224] Population growth, accompanied by corresponding increases in municipal tax revenues, is unlikely to have any significant effect on the per capita tax revenues. Alternatively, expansion of city land area generally means more tax revenue for the municipalities, although not necessarily more people (as it is often done at the expense of unincorporated areas), yielding a positive relationship with the tax levels. Per capita federal and state grants are expected to relieve the pressure on own tax revenue sources since senior government aid can be substituted for local tax levies.[225]

Finally, it is expected that all tax levels and per capita user fees are positively related to both special purpose (fire/emergency/transportation) and regular purpose expenditures (with special property levies financing emergency services, and with utility taxes and

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[224] Both positive and negative signs on income variables are reported in the empirical tax competition literature for local property, sales and personal income taxes. Unfortunately no such cross referencing is possible for municipal business taxation. Buettner (2001) and Feld and Kirchgässner (2002), who study local business taxes in Germany and Switzerland respectively, do not include any income variables in their estimating equations.

[225] In cross-section regressions, more federal and state aid would be possibly correlated with lower taxes per capita.

user fees financing transportation). As these expenditures rise, greater revenues are required to fund them.

The municipal reaction functions (12)-(15) are estimated separately for 2001 and 2005. This is preferred to estimation using data for the entire period 2001-2005 for two reasons. First, the decline in state government transfers and the introduction of additional fiscal constraints during 2001-2003 are likely to cause structural breaks. Second, one of the goals of the present study is to identify changes in municipal strategic behaviour associated with reduced government help and tougher fiscal restrictions. A comparison of the estimates for 2001 and 2005 is expected to reveal these differences.[226]

As noted above, due to the potential endogeneity of some of the explanatory variables, an IV estimation approach is employed.[227] The instruments include the previous year values of all the endogenous variables, PROPT, SALEST, BOT, UTILT, FEES, INCOME, SPECEXPN, REGEXPN and NPROPT, NSALEST, NBOT, NFEES, as well as current year values of all the exogenous variables, FEDAID, STATEAID, POP, AREA, and the additional instruments, YOUNG, OLD, CAREA, and previous year values of both per capita grants.[228] The use of the single-equation 2SLS method ensures that the misspecification of any of the tax equations is not transmitted to the estimates of the other equations.

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[226] Not all data are available prior to 2000. Data from 2000 and 2004 are needed to generate lagged variables.

[227] All estimates are performed using LimDep version 8.0.

[228] Although POP and AREA are found to be highly correlated (their correlation coefficient is 0.87), their consecutive exclusion from the estimating equation shows no effect on the estimation results. Both variables are also simultaneously included in the estimating equation of Heyndels and Vuchelen (1998).

4.5. Results

4.5.1. Estimation Results for 2001

Table 4.11 reports the estimates using 2001 data for 252 cities with the population based weights used to create the neighbour variables. The same year estimates for the other weighting schemes are presented in Tables 4.23-4.26 of the Appendix. In all the results tables, the coefficients and their corresponding t-statistics (in parentheses) are indicated in bold if the coefficient is significant at the 5% level. Coefficients that are significant at the 10% level, but not at 5%, are indicated by bold italics. As can be seen from the tables, all weighting schemes are fairly consistent in identifying the tax level determinants. This uniformity suggests that the results in Table 4.11 appear to be robust to the choice of weighting scheme used to define the neighbours.

B&O taxes respond negatively to changes in own property taxes. Thus, substitutability between these two tax revenue sources is found to be mutual. The inter-municipal positive relationship in the B&O taxes (along with the other results of the BOT regression) should be treated cautiously as it will be subjected to further empirical investigation as a result of the low level of B&O tax usage. B&O tax choice also appears to respond significantly to neighbours' sales taxes. With sales tax rates being fixed (at their maximum 1% limit), any increases in municipal sales tax revenues result from increases in the taxable sales. Therefore, choosing to collect higher B&O tax revenue whenever the neighbours' sales tax revenues are higher is consistent with the common practice of exporting a part of the municipal B&O tax burden, mentioned in Yates (2003).

Table 4.11: Tax Level Regressions, 2SLS, Population Based Weights, 2001

Dependent variable / Explanatory variable	Property Tax Level	B&O Tax Level	Utility Tax Level	Per Capita User Fees
$PROPT_i$	—	**-0.1089 (-2.853)**	-0.0743 (-1.298)	-0.4734 (-1.627)
$SALEST_i$	-0.0487 (-1.193)	***-0.0311 (-1.725)***	0.0324 (0.121)	**-0.5456 (-4.205)**
BOT_i	**-0.3968 (-2.409)**	—	0.0733 (0.668)	-0.1774 (-0.317)
$UTILT_i$	-0.1157 (-1.056)	0.0313 (0.644)	—	0.3793 (1.040)
$FEES_i$	-0.0334 (-1.437)	-0.0034 (-0.332)	0.0172 (1.129)	—
$INCOME_i$	**0.0013 (4.268)**	**-0.0003 (-1.998)**	-0.0001 (-0.509)	-0.0012 (-1.094)
POP_i	0.0003 (1.565)	**0.0003 (3.626)**	-0.0002 (-1.081)	**0.0015 (2.057)**
$AREA_i$	-0.8921 (-0.890)	-0.2211 (-0.498)	**1.7491 (2.717)**	-4.7536 (-1.431)
$FEDAID_i$	**-0.0666 (-3.151)**	-0.0037 (-0.382)	**-0.0321 (-2.272)**	**-0.4657 (-7.369)**
$STATEAID_i$	**-0.1200 (-5.740)**	**-0.0204 (-1.992)**	**-0.0597 (-4.070)**	**-0.4679 (-6.797)**
$SPECEXPN_i$	**0.6100 (7.676)**	**0.2048 (5.170)**	**0.2130 (3.508)**	**0.6895 (2.192)**
$REGEXPN_i$	**0.0636 (5.338)**	0.0064 (1.110)	**0.0214 (2.532)**	**0.4170 (14.216)**
$NPROPT_i$	**0.2533 (2.336)**	-0.0019 (-0.039)	-0.0520 (-0.721)	0.2579 (0.702)
$NSALEST_i$	-0.0271 (-0.395)	**0.0689 (2.300)**	0.0491 (1.099)	***0.3783 (1.671)***
$NBOT_i$	-0.0554 (-0.361)	**0.1961 (2.959)**	-0.0393 (-0.393)	**-1.4581 (-2.931)**
$NUTILT_i$	0.0988 (0.592)	0.0381 (0.517)	0.1121 (1.032)	-0.2830 (-0.510)
$NFEES_i$	-0.0174 (-1.060)	***-0.0136 (-1.882)***	-0.0046 (-0.425)	***0.1027 (1.893)***
Constant	**-57.3366 (-2.507)**	-9.8003 (-0.948)	21.3980 (1.408)	8.1753 (0.105)
R^2	0.52	0.27	0.39	0.62

The utility taxes are the only taxes that do not exhibit any significant own or neighbour tax effects. As expected, cities do not respond to each other's utility taxes. In contrast, user fee proceeds prove to be substitutable with own sales tax revenue. The user fees are also negatively related to neighbours' B&O taxes. However, the evidence for inter-jurisdictional strategic interaction of user fees is weak as the coefficient on NFEES is only significant at 10% (and from Table 4.26 of the Appendix, the evidence of the different weighting schemes on user fee interdependence is somewhat diverse with the population based weights, providing estimates in the middle).

The own and neighbour tax effects of the Washington municipalities can be summarized as follows. Own tax effects are not as numerous as one might anticipate. The B&O tax appears to be a significant substitute for the property tax and vice versa. Substitutability between own user fees and the sales tax is less expected, but may reflect the importance of property and sales taxes and user fees as municipal revenue sources. Neighbour tax effects mostly appear to be with respect to the same tax of the neighbours or with respect to taxes that are close substitutes, such as B&O and sales taxes. The substitutability between own user fees and the neighbours' B&O taxes is a less intuitive finding.

Table 4.11 also offers insight into various non-tax determinants of municipal taxes. As expected, almost all taxes are negatively correlated with per capita federal and state grants and are positively correlated with both per capita expenditure measures, except for the coefficients in the B&O tax equation for the cases of federal aid and regular expenditure.[229] Both property and B&O taxes are significantly related to median income. As higher income people are likely to own expensive properties, their presence means more property tax revenue per capita: an increase in median income by $1000 translates into $1.3 more in tax revenue per capita. The opposite result is found for B&O taxes: higher income residents consume and invest more, making the B&O tax less desirable within the jurisdiction (as there is less tax exporting in this case).[230] B&O taxes, along with per capita user fees, also respond positively to population size. This relationship with the B&O tax tends to confirm that the tax is mostly used by larger cities. The

[229] Other versions of REGEXPN were also tested: 1) excluding debt payments from regular purpose expenditures, 2) excluding REGEXPN, and 3) replacing REGEXPN with only utility related expenditure. They were found to produce 2SLS estimates with lower goodness-of-fit measure for both 2001 and 2005.
[230] Or possibly, in the jurisdiction with higher income earners more taxes are collected from the other revenue sources, reducing the need for a higher B&O tax.

positive correlation between population and per capita user fees may indicate that a greater range of services is generally offered by more densely populated cities. Utility taxes are linked to occupied area, with the bigger municipalities enjoying higher utility tax revenue collections. This relationship may simply reflect the fact that cities with larger square mile areas have more utility services to tax and provide more utility services.[231]

The deteriorating economic and fiscal conditions in Washington in 2001 may be the cause of some aspects of the empirical findings reported above. The year 2001 saw the beginning of the September 11 slowdown combined with the on-going contraction of the aerospace industry and the structural shift from manufacturing to services – a combination that spawned a mild recession (that ended in 2002). Most municipal tax receipts quickly declined during this year. In average per capita terms, user fees dropped by $24, sales taxes by $10 and B&O taxes by $5, although property and utility taxes did not change from the level of the previous year. Because municipalities might temporarily choose not to respond to decreases in neighbours' taxes, attributing them to recession, rather than to strategic behaviour, the adverse economic conditions may have reduced the evidence of tax interdependence. This makes a comparison of the results to those of a non-recessionary period more interesting.

The fiscal restrictions of the day may also have played a role in shaping the results presented in Table 4.11. In 1997, the existing 6% limit on property tax revenue growth was revised to the lesser of 6% or the inflation rate. As the rate of inflation did not exceed 4% in 2001, municipal property tax revenue growth was effectively capped at this

[231] Examination of data confirms that cities with larger square mile areas not only collect more in utility tax revenue, but also spend more on utility services.

rate. The value of 0.25 for the coefficient on NPROPT in the first column of Table 4.11 happens to be very much in agreement with the values of 0.23-0.37 obtained by Brueckner and Saavedra (2001) for business property taxes under a similar but tougher limitation.[232]

Weak economic conditions in 2001 and changing tax regulations are reasons to examine the extent of tax interactions in another year. Thus, the model is re-estimated using data for 2005. First, however, we explore alternative methods of estimation of the B&O tax equation.

4.5.2. Alternative Approaches to B&O Tax Estimation, 2001

The results of the TOBIT regression are presented in Table 4.27 of the Appendix. Despite certain differences in the TOBIT and 2SLS outcomes (see the brief discussion following Table 4.27 in the Appendix), both models identify a number of common factors related to the magnitude of the B&O tax response, indicating that the 2SLS results are not inconsistent with the TOBIT results. However, the TOBIT estimates have not been adjusted to take account of the potential endogeneity of the explanatory variables, making the estimates less able to conclusively confirm the presence of strategic interactions in current B&O taxes.[233]

The presence or absence of tax competition with respect to the B&O tax may influence the municipal decision on whether to use this tax and this, in turn, may affect the strategic behaviour of the B&O tax levying cities. The estimation of the PROBIT model for the B&O tax can provide interesting background information for B&O tax

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[232] In fact, Initiative 722, designed to restrict annual increases in regular property levies to 2%, was approved by the voters in 2000 but was overturned in the courts shortly afterwards.

[233] Although the results of the TOBIT model using the previous year's values of the explanatory variables are not that different from the reported results, this study is interested in the interaction of current taxes.

interdependence by revealing the determinants of, and perhaps motives for, adopting a B&O tax. As tax implementation normally takes time, the model is estimated using data from the previous year,[234] the data which was employed as the instruments to derive the 2SLS estimates above, and these estimates are later used in the Wooldridge procedure to adjust for sample selection. The PROBIT results are reported in Table 4.12.

Table 4.12: B&O Tax Level Regression, PROBIT, Population Based Weights, 2001

Explanatory variable	**Coefficient and its statistics**
$PROPT_0$	-0.0013 (-0.591)
$SALEST_1$	**-0.0039 (-2.492)**
$UTILT_0$	**0.0073 (2.459)**
$FEES_0$	-0.0007 (-1.153)
$INCOME_0$	***-0.00001 (-1.662)***
POP_1	-0.000006 (-1.063)
$AREA_1$	***0.0410 (1.774)***
$CAREA_1$	0.0826 (0.260)
YOUNG	**-0.0848 (-2.229)**
OLD	-0.0425 (-1.519)
$FEDAID_0$	0.0001 (0.084)
$STATEAID_0$	-0.0009 (-0.786)
$FEDAID_1$	0.0001 (0.133)
$STATEAID_1$	-0.0001 (-0.044)
$SPECEXPN_0$	**0.0046 (2.493)**
$REGEXPN_0$	0.0004 (1.002)
$NPROPT_0$	0.0017 (0.551)
$NSALEST_1$	**0.0045 (2.200)**
$NBOT_0$	0.0047 (1.314)
$NUTILT_0$	-0.0026 (-0.521)
$NFEES_0$	0.0004 (0.947)
Constant	0.4708 (0.279)
Log likelihood	-66.4206
# of correctly predicted 0 (out of 214)	210
# of correctly predicted 1 (out of 38)	16

[234] It is also important to use previous year data due to potential endogeneity.

Table 4.12 indicates that the ability to export a part of the B&O tax burden and the need to finance a greater range of the public services (i.e., the significant coefficients on NSALEST and SPECEXPN, respectively) remain important factors explaining the adoption of the B&O tax. The level of the own sales tax levy also influences the choice of the B&O tax: the higher is own sales tax revenue, the less use is made of a B&O tax. The presence of utility tax seems to increase the probability of B&O tax adoption. Any impact from the neighbours' B&O taxes is notably absent.[235] The negative YOUNG coefficient indicates that a B&O tax is less likely to be used, the larger the proportion of young in the population (possibly, due to their lack of purchasing power).

The majority of the municipalities without a B&O tax may dominate the 2SLS estimates on the full sample, raising questions about whether these results actually reflect behaviour of the cities that levy the B&O tax. Wooldridge (2002) suggests a method of checking for, and adjusting for, sample selection bias when estimating the B&O tax equation only on those observations for cities that use the B&O tax. This method is as follows: first, the PROBIT model is estimated on the entire municipal sample to obtain the inverse Mills ratios;[236] second, the 2SLS model of B&O taxes is estimated on the restricted sample (only the municipalities that use the B&O tax) with the inverse Mills ratios included as a new explanatory variable and instrument. The presence of sample selection bias can be tested by testing the inverse Mills ratio for significance (where significance indicates sample selection bias). The results indicate that the inverse Mills

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[235] Using a dummy variable (one, if at least one neighbour has B&O tax, and zero otherwise) instead of NBOT makes its positive coefficient significant (the other PROBIT results remain unchanged). This indicates that while neighbours' B&O tax revenue collection is not important, the tax presence in their finances is.

[236] The inverse Mills ratio or hazard rate is calculated as a ratio of the probability density function over the cumulative distribution function for a censored variable. The inverse Mills ratios are positive when the dependent dummy variable is one and are negative when it is zero.

ratio is not significant at the 5% level, so no sample selection bias is detected (these estimates are not reported here). As a result, the inverse Mills ratio is dropped from the 2SLS estimating equation for the restricted B&O tax sample and the model is re-estimated. The results are presented in Table 4.13.

Table 4.13: B&O Tax Level Regression, 2SLS, Population Based Weights, Restricted Sample, 2001*

Explanatory variable	**Coefficient and its statistics**
PROPT1	0.1445 (0.859)
SALEST1	***0.1701 (1.807)***
UTILT1	-0.3451 (-1.501)
FEES1	**0.0722 (2.205)**
INCOME1	**-0.0023 (-2.514)**
POP1	**0.0004 (2.242)**
AREA1	-1.7449 (-1.569)
FEDAID1	0.0497 (0.436)
STATEAID1	-0.1296 (-0.782)
SPECEXPN1	0.0811 (0.587)
REGEXPN1	**-0.0259 (-2.034)**
NPROPT1	0.0190 (0.125)
NSALEST1	0.0291 (0.399)
NBOT1	**0.8498 (3.374)**
NUTILT1	***-0.6850 (-1.820)***
NFEES1	-0.0223 (-0.910)
Constant	**187.6706 (3.065)**
R^2	0.63

* the sample is now restricted to 38 B&O tax levying municipalities

Comparing these results with the 2SLS estimates using the full sample (the second column in Table 4.11) reveals more differences than similarities. To begin with, the restricted sample fits the model much better, yielding R^2=0.63 (versus R^2=0.27 in Table 4.11). The competitive interactions in B&O taxes are still present, but the NBOT

coefficient becomes stronger in magnitude and significance.[237] Own tax effects now consist of complementarily of B&O tax with user fees (likely due to heavier use of fees by cities with larger business sectors), rather than substitutability with the property tax, and there are no neighbour tax effects involving neighbours' sales taxes.[238] Although the coefficients on median income and population remain significant, state grants and special purpose expenditure do not appear to determine the existing level of B&O taxes. Instead, this level depends on regular purpose expenditure, with lower B&O taxes linked to higher regular purpose expenditures. Clearly, the inclusion of the municipalities without B&O taxes in the sample biases the estimates of the responsiveness of cities with B&O taxes.

The following conclusions are reached based on the results of the alternative B&O tax estimates. First, the TOBIT results tend to be consistent with the 2SLS estimates. However, the TOBIT model does not take into account the endogeneity of the explanatory variables. Second, the PROBIT model is estimated to investigate the B&O tax choices as well as to correct for sample selection bias in the restricted sample. The PROBIT estimates predict the observations without a B&O tax (210 of 214) better than those with a B&O tax (16 of 38), probably because the presence of so many zeros drives the results. Third, although the Wooldridge procedure detects no sample selection bias, it reveals that the cities with B&O taxes interact differently than the average interactions of all cities in the sample. Significant and large interactions among the municipalities with B&O taxes are found.

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[237] The average value of NBOT in the restricted sample went up to 76.39 (from 31.75 with 252 cities included). Out of 38 municipalities in the restricted sample, 29 have neighbours with B&O taxes.

[238] There is a concern about omission of some potentially important mutual fiscal influences due to a considerable sample reduction (from 252 to 38). Many municipalities are excluded from the sample, but some remain as neighbours, even if they do not have a B&O tax, in the averaged tax variables, other than the B&O tax levels.

4.5.3. Estimation Results for 2005

The reaction functions (12)-(15) are now estimated by 2SLS with the same exogenous and endogenous variables, using 2005 data (as well as lagged data from 2004 as instruments) for 253 cities. The results for the population based neighbour weights are reported in Table 4.14 below and the results for the other weight types are given in Tables 4.28-4.31 of the Appendix. Once again all estimates are quite consistent in identifying the tax level determinants, although the population based weighting scheme now provides the best overall fit.[239]

Table 4.14: Tax Level Regressions, 2SLS, Population Based Weights, 2005

Dependent variable / Explanatory variable	Property Tax Level	B&O Tax Level	Utility Tax Level	Per Capita User Fees
$PROPT_5$	—	-0.0553 (-1.541)	**-0.2124 (-3.387)**	**-1.1151 (-3.116)**
$SALEST_5$	**-0.1502 (-2.859)**	-0.0117 (-0.620)	**-0.0855 (-2.569)**	**-0.7919 (-4.630)**
BOT_5	-0.1785 (-0.960)	—	0.1214 (1.044)	0.2060 (0.296)
$UTILT_5$	**-0.3807 (-2.836)**	0.0681 (1.417)	—	-0.7454 (-1.457)
FEES5	**-0.1444 (-4.182)**	0.0083 (0.642)	**-0.0535 (-2.330)**	—
$INCOME_5$	0.0004 (1.149)	**-0.0003 (-2.688)**	-0.0003 (-1.467)	**-0.0030 (-2.306)**
POP_5	0.0002 (0.821)	**0.0004 (3.848)**	-0.0002 (-0.909)	0.0006 (0.583)
$AREA_5$	-0.6911 (-0.567)	-0.3898 (-0.928)	***1.4608 (1.943)***	-0.5693 (-0.125)
$FEDAID_5$	**-0.1824 (-5.201)**	-0.0005 (-0.034)	**-0.0961 (-4.096)**	**-0.8073 (-8.333)**
$STATEAID_5$	**-0.1821 (-6.106)**	-0.0083 (-0.684)	**-0.1074 (-5.377)**	**-0.6424 (-6.667)**
$SPECEXPN_5$	**0.4944 (5.794)**	**0.1187 (3.547)**	**0.1800 (2.992)**	0.1534 (0.414)
$REGEXPN_5$	**0.1490 (6.457)**	-0.0007 (-0.069)	**0.0805 (5.079)**	**0.6556 (13.574)**
$NPROPT_5$	**0.4088 (3.572)**	-0.0013 (-0.031)	0.1218 (1.612)	**1.1033 (2.574)**
$NSALEST_5$	-0.0280 (-0.339)	0.0208 (0.755)	0.0151 (0.302)	***0.5233 (1.807)***
$NBOT_5$	0.0100 (0.053)	**0.3142 (5.049)**	-0.0920 (-0.778)	**-1.4828 (-2.191)**
$NUTILT_5$	-0.1470 (-0.856)	0.0275 (0.464)	0.0138 (0.128)	-0.8819 (-1.398)
$NFEES_5$	-0.0316 (-1.631)	**-0.0197 (-2.963)**	-0.0064 (-0.525)	0.0338 (0.463)
Constant	15.3664 (0.576)	5.7517 (0.624)	**38.6668 (2.364)**	81.0932 (0.819)
R^2	0.41	0.38	0.11	0.42

[239] The reduced explanatory power of most equations in 2005 compared with 2001 may be, at least in part, attributed to the increased restrictiveness of the constraints on property tax usage. Increased explanatory power of the BOT equation may be partially attributed to more uniformity in B&O taxes.

The main strategic picture is still similar to that for 2001. For the PROPT equation, increases in own sales and utility tax revenues or in user fee proceeds tend to accompany lower property taxes. A competitive relationship in the property taxes of different jurisdictions persists, but a higher value of the NPROPT coefficient (0.41 versus 0.25 in 2001) now reflects a stronger response of the own property tax to those of neighbours.[240] With no neighbour tax effects present, property taxes continue to be determined by local fiscal conditions and neighbours' property taxation strategies.

Unlike the other taxes, the B&O tax estimates do not indicate increased interdependence between own tax revenue sources. In fact, the substitutability with the own property tax observed in 2001 disappears (although there is a potential for its complementarity with the own utility tax and own user fees under density based and uniform neighbour weights as indicated in the third and fourth columns of Table 4.29 in the Appendix). The competitive relationship with the B&O taxes of the neighbouring municipalities is still present. The own B&O tax is also found to respond in a small negative way to changes in neighbours' user fees. This relationship is mutual as the own user fees in the fourth column of Table 4.14 tend to be negatively and significantly correlated with the neighbours' B&O tax. With the coefficient on NFEES in the B&O tax equation being less than 0.02 in absolute value and the coefficient on NBOT in the user fee equation being greater than one, changes of larger magnitude in user fees are needed to match changes in B&O taxes. This may be due to the fairly limited use of B&O tax and fairly wide-spread use of user fees.

The utility taxes now display substitutability with all own revenue sources except BOT. Increases in property and sales tax revenues or increases/expansions of user fees

[240] In other words, as the majority of cities do not go up to the 1% limit, this constraint is not binding.

lead to lower utility taxes. At the same time, no significant effects appear with other neighbour taxes. As before, no strategic interaction is detected in the choice of utility taxes.

Within the same municipality, higher user fees result from lower property and sales tax revenues. In fact, any reduction in own property taxes translates into an almost one-to-one increase in own user fees (but not the other way around).[241] This possibly indicates that a common way of adjusting to the 1% restriction on the property tax growth is to raise user fees. Per capita user fees do not exhibit any evidence of inter-jurisdictional competitive tax setting behaviour, as the coefficient on the neighbours' user fee is insignificant. However, a new neighbour tax effect includes a one-to-one positive response of own user fees to the neighbours' property taxes. Thus, any increases in the property tax revenue of the surrounding municipalities would be accompanied, not only by increases in own property taxes, but also by increases/expansions of own user fees. This may be another potential consequence of a tougher constraint on property taxes. A negative relationship between own user fees and neighbours' B&O taxes is preserved and is greater than one in magnitude.

Own and neighbour tax effects may be summarized as follows. In 2005, substitutability appears among most of the own revenue sources, with the exception of B&O taxes. Property taxes show a substantial response to sales and utility taxes and to user fees. The largest responses, however, are by user fees to property and sales taxes. Responses to neighbours' taxes are more limited. Municipalities' property and B&O

[241] In theory, tax effects are expected to be symmetric (or mutual). It seems to remain true in the empirical studies using tax rates as strategic variables (Heyndels and Vuchelen (1998), Parys and Verbeke (2007)). In this study, common asymmetry between tax effects may be attributed to differences in magnitudes of municipal tax revenues, with larger revenues influencing smaller ones, but smaller revenues having little or no impact on larger ones.

taxes respond positively to increases in those same taxes in neighbouring jurisdictions. User fees appear to be very sensitive to neighbours' property, sales and (but negatively) B&O taxes. Own B&O taxes also react negatively to neighbours' user fees, but the degrees of response are dramatically different. Some of the tax effect response changes may, at least in part, have been induced by the 1% restriction on property tax revenue growth.

As for the non-tax local determinants of municipal taxes, there are only a few changes when compared with the previously discussed 2001 results. Property tax levels are no longer correlated with median income,[242] but higher median income leads to lower per capita user fees. Population size loses its significance in the user fees equation as does the occupied area in the utility tax equation. The property and utility taxes continue to be negatively related to federal and state grants and positively related to both expenditure types. The B&O taxes are found to be independent of senior government transfers and regular purpose expenditures. This is a change from the corresponding 2001 result where these taxes display substitutability with state grants. User fees also cease to be determined by special purpose expenditure.

The main differences between the results for 2001 and 2005 lie in the local economic and fiscal conditions. The recession of 2001 caused a quick decline in most municipal revenue sources. These were observed to rebound early in 2003 and to fully recover by 2005. However, the economic improvements of 2005 were accompanied by new and tougher restrictions on fiscal choices. These included the capping of the annual revenue growth of regular property taxes at 1% and a more uniform definition of the B&O tax

[242] Brett and Pinkse (2000) and Luna (2004) also report no significant effect of per capita income on property taxes and sales taxes, respectively.

base in accordance with the model ordinance. Along with existing tax limitations, these restrictions covered all the major municipal taxes, with the exception of user fees.

The changes in the economic situation and fiscal regulations between 2001 and 2005 may, to some extent, account for the differences in the estimates. The 2001-2002 recessionary retrenchment may have limited strategic interactions by making other issues dominant in local fiscal policies. The full economic recovery by 2005, along with modest increases in all per capita tax revenues, may be partially credited with enhancing inter-municipal responsiveness, as suggested by the larger significant estimated interaction coefficients for several tax variables.[243] In particular, any $1 per capita increase in neighbours' property taxes implies a $0.40 per capita increase in own 2005 property taxes, rather than the only $0.25 per capita increase of 2001.

With the 1% cap becoming effective in 2002, lower property tax revenue increases resulted as many cities exhausted their banked property tax capacities. As a consequence, the municipalities may be expected to switch to other tax revenue sources, contributing to the increased number of significant own tax interaction effects in 2005. This is not the case with the B&O tax model ordinance.[244] Its initial stage is suspected to merely slow down the growth in local B&O tax revenues, rather than to induce their reduction, translating into few changes in the general B&O tax results.

4.5.4. Expansion of Tax Revenue Sources under Binding Fiscal Restrictions

To test the relationship between higher growth in own regular property tax levies and growth in own other taxes, an additional variable called BITE is created and added to the

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[243] As can be seen from Table 4.32 of the Appendix, the expansion of property taxes is dominated by special property tax levies. Instead of increasing regular property tax revenues by the maximum of 1%, cities prefer to ask their voters to approve special levies, which have limited use and duration.

[244] The substitutability between the property and B&O taxes is probably lost because of the tougher constraints on both revenue sources.

tax equations, (12)-(15). The BITE variable is defined as BITE = D × Tax Level, where D is a dummy variable which takes on the value of one if regular property tax revenue growth in 2004-2005 is 0.9% or more and zero otherwise, and Tax Level is one of the per capita tax revenues (property, sales, B&O, utility or user fees) in 2005.[245] The use of BITE is intended to explore the following aspects of municipal fiscal policies. First, the increases in regular property taxes at the maximum allowable limit can be an indicator of larger municipal financial needs, which, in turn, may put upward pressure on the other taxes. Because the rate limits on the sales and utility taxes and unpopularity of the B&O taxes leave only user fees available for larger fiscal adjustments, a significant and positive correlation between user fees and property taxes is expected.[246] Second, the other tax relationships are difficult to predict as they may be particular to this group of cities.

The BITE variable is treated as endogenous and is instrumented by $D \times \text{Tax Level}_{i-1}$, where tax levels assume their 2004 values. Since its introduction has very little effect on the 2SLS outcomes, the results reported in Table 4.33 of the Appendix include only BITE definitions and BITE coefficients along with their significance in each of the tax equations. The municipalities with regular property tax levy increases of at least 0.9% per year are observed to make heavier use of fees (as reflected in the significant coefficient on BITE defined with respect to the property taxes in the user fee equation). Although there is some evidence of additional upward pressure on the other taxes (e.g., higher B&O taxes imply higher overall property taxes) and even substitutability between

[245] BITE defined as a dummy variable only proves insignificant in all tax equations.
[246] While user fees (as a dependent variable) are predict to be correlated with higher growing property taxes (entering BITE), the opposite is not expected to hold.

the close alternatives (e.g., higher sales taxes mean lower B&O taxes), these coefficients are significant only at 10%.

4.5.5. Alternative Approaches to B&O Tax Estimation, 2005

The B&O tax equation is estimated using TOBIT and the Wooldridge two-step procedure. The TOBIT estimates are presented in Table 4.34 of the Appendix, the PROBIT estimates required for the two-step procedure in Table 4.15 and the 2SLS estimates on the sample restricted to the 40 B&O tax levying municipalities are presented in Table 4.16.[247] As is evident from Table 4.34 of the Appendix, the TOBIT estimates are consistent with the 2SLS estimates of Table 4.14. As a result, they show little variation in the determinants of tax levels in 2005 versus 2001 (see Table 4.27 of the Appendix). One of the minor differences is the higher values of the NSALEST5 and NBOT5 coefficients, indicating greater importance of the sales and B&O taxes in the neighbouring jurisdictions.

The PROBIT estimates for 2005 are somewhat different from those of 2001 (see Tables 4.15 and 4.12). In addition to own sales taxes, own utility taxes, the proportion of young people and neighbours' sales taxes, the B&O tax usage choice now also depends on median income, the proportion of seniors and neighbours' B&O tax levels. Higher income residents (who potentially oppose business taxation due to their own investments) and more elderly people (who possess lower purchasing power) both make the presence of the B&O tax less desirable. Also, more attention is now paid to neighbouring jurisdictions since the availability of the B&O tax in the neighbours' finances helps sell it to the own voters and businesses, probably already exposed to the tax in one way or

[247] Three more cities adopted B&O taxes between 2001 and 2005 – Burien (2002), Des Moines (2005) and Kirkland (2003) – and one city abandoned this tax, Vancouver (2005).

another (e.g. shopping or selling through catalogs or the Internet). However, the results also show that the cities take less notice of own special purpose expenditures, although it is to those expenditures that most B&O tax revenue is normally allocated.

Table 4.15: B&O Tax Level Regression, PROBIT, Population Based Weights, 2005

Explanatory variable	Coefficient and its statistics
PROPT4	-0.0009 (-0.476)
SALEST5	**-0.0029 (-2.009)**
UTILT4	**0.0074 (2.299)**
FEES4	-0.0005 (-0.791)
INCOME4	**-0.00002 (-2.419)**
POP5	-0.000003 (-0.435)
AREA5	0.0193 (0.767)
CAREA5	-1.8879 (-1.101)
YOUNG	**-0.1189 (-3.149)**
OLD	**-0.0646 (-2.191)**
FEDAID4	-0.0017 (-0.885)
STATEAID4	-0.0010 (-0.564)
FEDAID5	0.0002 (0.230)
STATEAID5	-0.0009. (-0.554)
SPECEXPN4	0.0028 (1.537)
REGEXPN4	0.0002 (0.571)
NPROPT4	-0.0012 (-0.430)
NSALEST5	**0.0050 (2.725)**
NBOT4	**0.0093 (2.353)**
NUTILT4	0.0018 (0.370)
NFEES4	0.00006 (0.149)
Constant	2.4878 (1.464)
Log likelihood	-64.2052
# of correctly predicted 0 (out of 213)	205
# of correctly predicted 1 (out of 40)	17

The Wooldridge two-step method does not detect any selection bias in the restricted sample of 2005 and so the inverse Mills ratio is dropped from the estimating equation. As can seen from Table 4.16, the number of variables with significant coefficients using

Table 4.16: B&O Tax Level Regression, 2SLS, Population Based Weights, Restricted Sample, 2005

Explanatory variable	Coefficient and its statistics
PROPT5	0.0293 (0.209)
SALEST5	**0.2588 (2.436)**
UTILT5	-0.0248 (-0.133)
FEES5	0.0497 (1.254)
INCOME5	**-0.0016 (-2.827)**
POP5	0.0002 (1.003)
AREA5	-0.9737 (-0.781)
FEDAID5	***-0.2564 (-1.714)***
STATEAID5	-0.2763 (-0.950)
SPECEXPN5	-0.1475 (-0.894)
REGEXPN5	0.0126 (0.521)
NPROPT5	0.2654 (1.434)
NSALEST5	-0.1008 (-0.856)
NBOT5	0.3346 (1.174)
NUTILT5	-0.3016 (-0.816)
NFEES5	**-0.0620 (-2.427)**
Constant	**142.4579 (2.040)**
R^2	0.62

data only for the B&O tax levying municipalities is lower in 2005 than in 2001,[248] although the fit is barely affected (see Table 4.13). No significant interdependence is present in the B&O tax levels, although the coefficient on NBOT5 stays positive in sign. The adoption of the first round of mandatory rules under the model ordinance may have weakened the interactions witnessed in property taxes several years earlier.[249] In terms of tax effects, B&O tax is now observed to be complementary with the sales tax (with higher taxable sales implying higher B&O tax revenue) and substitutable with neighbours' user fees (with heavier reliance on user fees across the border putting

[248] This change is not inconsistent with a similar pattern in the full 2SLS estimates.
[249] With more losses to follow the second round of the business income allocation and apportionment provisions in 2008, such interruption may prove to be long-lasting or even permanent.

downward pressure on own B&O tax). Median income remains the only local non-tax determinant of the actual B&O tax level.

A comparison with the 2SLS estimates of the B&O tax for 2005 (second column of Table 4.14) reveals that the response of the cities with a B&O tax is biased by the inclusion of the numerous jurisdictions without it. The results of Table 4.16 register no impact of population, special purpose expenditure or neighbours' B&O taxes on the actual choice of B&O tax. Alternatively, the estimated effects of median income and neighbours' user fees seem to be greater in magnitude (in absolute value) for the smaller sample.

The following conclusions may be drawn from the alternative B&O tax estimates. First, the TOBIT results are consistent with the 2SLS estimates. Second, the PROBIT model indicates several changes in the determinants of the B&O tax adoption. However, some of the identified B&O tax usage determinants are still consistent with those of the TOBIT and 2SLS models. Third, although no sample selection bias is detected for the B&O tax levels, the Wooldridge procedure fails to confirm any direct interdependence between the own and neighbours' B&O taxes. This result is not unanticipated as the tax revenue losses imposed on the entire B&O tax municipal community by the model ordinance provisions are likely to dominate local B&O tax strategies.[250]

4.6. Conclusions

The empirical findings on the simultaneous determination of three major taxes and per capita user fees in the competitive municipal setting of Washington State yield

[250] Yates (2005, p.7) mentions that the adoption of unified tax base definitions in 2003 negatively impacted B&O tax revenues, although no exact B&O tax revenue loss number is given. However, on page 3 she states that only during 2008 (the first year the allocation and apportionment rules take effect) the total B&O tax losses will constitute at least 23.3 million dollars more.

several results. Washington municipalities interacted strategically when setting their property tax levels in 2001, before the 1% cap was placed on the growth of regular property tax revenues, and they continued to interact in 2005 after this measure was fully established. The flexibility in the 1% limit leaves room for strategic responses and the larger significant coefficient estimate in 2005 suggests even greater responsiveness in 2005 than in 2001.[251]

The local B&O tax presents a tougher challenge for the empirical analysis because this tax is used by only 15-16% of all municipalities, normally bigger cities with a potential for shifting the B&O tax burden to non-resident businesses and citizens. Responsiveness to neighbours' B&O taxes appears to be larger in 2001 than in 2005. The latter may be the result of an effort to unify the B&O tax base through a set of mandatory rules known as the model ordinance.

The determinants of the existing B&O taxes (using full sample) tend to differ more from the incentives for the B&O tax adoption in 2005. While opportunity to export part of the B&O tax burden to non-residents remains one of the major incentives for the tax adoption, the extent to which it can be carried out is greatly reduced. Other changes in the tax adoption incentives involve greater importance of own socio-economic characteristics whereas in the tax determinants their less importance. All these differences may be attributed to the model ordinance, set not only to unify the B&O tax base, but also to reduce (and later eliminate) common B&O tax burden exporting practices. From now on, the cities, considering the B&O tax adoption, have to rely on own fiscal capacities for B&O tax revenue collection. However, the B&O tax revenue

[251] In fact, the 1% limit (Initiative 747) was ruled by the State Supreme Court unconstitutional in November 2007, six years after it was first implemented. This development may provide another opportunity to observe municipal adjustments to regulatory change.

losses inflicted by the new rules may have dominated the current choices of the municipal B&O taxes, making them less responsive to own conditions.

No competitive interactions are detected in the choice of utility taxes. This outcome is not unexpected as many municipalities are known to have reached the maximum allowable rates of 6% on the two greatest revenue-yielding utility tax types (telephone and electricity) and to have been reluctant to increase their rates on the unregulated utilities (garbage, water, sewer and drainage).[252] One of the motives behind using the maximum tax on regulated utilities is the potential for the tax burden to be exported by cities with publicly owned and operated utilities, which represent the majority of cases.

The estimated tax competition coefficients associated with per capita user fees are only close to being significant in 2001, and are insignificant in 2005. The considerable expansion of the use of user fees, combined with evidence of strong upward pressure on the use of these fees in the municipalities that closely follow or exceed the 1% property tax growth limit, tends to indicate that user fees are increasingly employed to accommodate increases in the demand for services due to economic growth when tax regulations limit the expansion of other revenue sources. These forces, rather than strategic interaction between cities, have been the main determinants of user fees.

There are considerable differences in the estimated interaction effects between own taxes in 2001 and 2005. In 2001, the substitutability among the own tax revenue sources is centered around the property tax, reflecting the importance of this tax as a municipal revenue source. In 2005, the focus of substitutability shifts from the property tax towards

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[252] Association of Washington Cities (2005, p.103) contains a survey of 212 cities indicating that while 70% of those cities increased utility rates during 2002-2004, only 35% increased utility taxes during 1999-2004. Other most common tax adjustments included increases in user fees (78% during 2002-2004) and in property taxes (60% during 1999-2004).

the property tax and user fees and involves a larger number of the other own taxes. These changes may be, to some extent, induced by the tougher restrictions on property tax growth (prompting higher growth in special property levies[253]) and the growing importance of user fees (although the latter may not be independent of the restrictions).

Finally, neighbour tax effects are not numerous. However, there is considerable consistency in the response to changes in neighbours' other taxes. One of the minor changes in neighbour tax effects is the generally larger coefficient estimates for 2005. This is expected to be, at least in part, explained by the economic recovery.

These findings imply several policy implications for state governments. First, revenue growth limits and tax rate limits are not suited for adjusting the strength of competitive municipal interactions. Their effects on municipal tax responses differ, depending on how closely the majority of local jurisdictions choose to follow these limits. Second, when access to additional and constrained taxes is available, limits on the growth of property tax revenues can effectively prevent over-utilization of property taxes by promoting greater interdependence between own tax revenue sources. Third, regulations aimed at reducing or eliminating tax exportation opportunities appear to affect municipal strategic behaviour by making tax competition more difficult.

[253] Other possibilities to raise more property tax revenue without using up the 1% growth limit include new construction and increases in state assessed property.

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4.8. Appendix

Table 4.17: Summary of Major Studies on Local Government Interactions

Author(s)	**Model details**	**Approach details**	**Estimation method**	**Model issues/ extensions**
Luna (2004)	Sales tax $= \beta_0 + \beta 1$Lagged neighbour averaged sales taxes $_{it-1} +$ β_2Lagged sales tax base $+\beta_3$Lagged expenditure $+ \beta_4$lagged property tax revenue $+ \beta_5$Lagged grants$+ \beta_6$State sales tax $+ \Sigma\beta_{7\text{-}10}$Demographic variables $+ \Sigma\beta_{11\text{-}104}$Dummy for fixed affects $+ \nu_1$ Sales tax base $= \gamma_0 + \gamma_1$Sales tax $+ \gamma_2$Neighbour averaged sales taxes $+$ γ_3Transportation cost $+ \gamma_4$State sale tax $+ \gamma_5$Per capita income$+ \Sigma\gamma_{6\text{-}10}$Demographic variables $+ \Sigma\gamma_{11\text{-}104}$Dummy for fixed affects $+ \nu_2$	Sales tax is % rate; weights are population based; panel data is used for 1977-1993.	2SLS (also OLS for the reduced form equation).	The model is LR; also checks on SR model with differenced variables.
Brueckner & Saavedra (2001)	Property tax $= \alpha_0 + \alpha_1$Neighbour weighted property taxes $+ \alpha_2$Log per capita income $+ \alpha_3$Log per capita state aid $+ \alpha_4$Log population proportion of 16&more with education $+ \alpha_5$Annual rate of population growth $+ \alpha_6$Log population proportion of African-American $+ \alpha_7$Log per capita public sector earnings $+ \alpha_8$Log population $+$ u	Property taxes are effective (total property tax revenue / total market property value); weights are distance and population based; cross-section data is used for 1980 and 1990.	ML and then OLS (claiming test results are robust).	The equation is estimated with different weighting schemes.
Heyndels & Vuchelen (1998)	Property tax $= \alpha_0 + \alpha_1$Neighbour averaged property taxes $+$ α_3Population $+ \alpha_4$Instrumented per capita income $+ \alpha_5$Percentage of young $+ \alpha_6$Percentage of old $+ \alpha_7$Area $+ \alpha_8$Instrumented income tax $+u_1$ Income tax $= \beta_0 + \beta_1$Neigh averaged income taxes $+ \beta_3$Population $+$ β_4Instrumented per capita income $+ \beta_5$Percentage of young $+$ β_6Percentage of old $+ \beta_7$Area $+ \beta_8$Instrumented property tax $+u_2$	Property and income taxes are % rates; weights are uniform; cross-section data is used for 1990.	3SLS (equations are run separately)	Income is instrumented using all other variables for previous years. Second set of neighbours is

Author(s)	Model details	Approach details	Estimation method	Model issues / extensions
				introduced later.
Brett & Pinkse (2000)	Total business property tax = $\beta_0 + \beta_1$Log assessed property value + β_2Business property tax not set locally + β_3Mediam family income + β_4Fraction of seniors + β_5Hecters of park per capita + ν_1 Log assessed property value = $\gamma_0 + \gamma_1$Total business property tax + γ_2Neigh averaged total business property taxes + γ_3Median family income + γ_4Hecters of park per capita + γ_5Meters of road per capita + γ_6Percentage workforce employed in primary industries + γ_7Neigh averaged median family income + γ_8Neigh averaged percentage workforce employed in primary industries+ ν_2	Business property taxes are in mils (dollar tax liability per thousand dollars of taxable value); weights are distance based; cross section data is used for 1987 and 1991.	2SLS (also OLS for the reduced form equation).	Random effects and fixed effects estimations are also performed.
Ladd (1992)	Tax burden = $\alpha_0 + \alpha_1$Neigh averaged tax burdens + α_2Per capita income in 1978 in 1982 dollars + α_3Public school enrolment in 1978 as fraction of 1978 population + α_4Population density per square mile in 1978 + α_5 Dummy for central city in county + α_6Dummy for metropolitan area in more than one county + α_7State dummy + u	Tax burdens are tax revenues / personal income; weights are uniform; cross section data is used for 1978 and 1985	Instrumental variable (2SLS)	Tax burdens are estimated for total taxes, property taxes, residential property taxes, general sales taxes, other taxes
Buettner (2001)	Combined business revenue and property tax = $\alpha_0 + \alpha_1$Neigh weighted business revenue and business property taxes + α_2National business revenue and business property tax + α_3District business revenue and business property tax + α_4Own lagged business revenue and business property tax + α_5Per capita lagged income tax revenue + α_6Per capita lagged grants + α_7Per capita lagged debt payments + α_8Per capita lagged standardized land tax revenue + α_9Per capita lagged standardized business tax revenue + α_{10}Per capita lagged county contributions + α_{11}Per capita lagged welfare expenditure + α_{12}Dummy for linear trend +	Property and income taxes are % rates; weights are distance based; panel data is used for 1980-1996.	Instrumental variable (2SLS)	

Author(s)	Model details	Approach details	Estimation method	Model issues/ extensions
	α_{13}Log total lagged population + α_{14}Lagged share of people younger than 15 + α_{15}Lagged share of people younger than 25 + α_{16}Lagged share of people younger than 40 + α_{17}Lagged share of people younger than 65+ α_{18}Share of Protestant state church population + α_{19}Share of Protestant free church population + α_{20}Share of Catholic population + α_{21}Lagged share of foreign nationals + α_{22}Lagged share of employed + α_{23}Dummy for Swiss border +α_{24}Dummy for ditto in neighbourhood +α_{25}Dummy for French border + u			
Parys & Verbeke (2007)	Property tax = α_0 + α_1Neigh averaged property taxes + α_3Neigh averaged income taxes + α_4Size of workforce relative to neighbours + α_5Ratio of employees per resident+ α_6Size of population relative to neighbours + α_7Percentage of young people + α_8Percentage of old people + α_9Per capita grants + α_{10}Area per resident + α_{11}Per capita residential space+ α_{12}Per capita economic activity area + α_{13}Per capita property tax base + α_{14}Per capita income tax base + α_{15}Share of apartments in residential space+u_1 Income tax = β_0 + β_1Neigh averaged income taxes + β_3Neigh averaged property taxes + β_4Size of workforce relative to neighbours + β_5Ratio of employees per resident+ β_6Size of population relative to neighbours + β_7Percentage of young people + β_8Percentage of old people + β_9Per capita grants + β_{10}Area per resident + β_{11}Per capita residential space+ β_{12}Per capita economic activity area + β_{13}Per capita property tax base + β_{14}Per capita income tax base + β_{15}Share of apartments in residential space+u_2	Property and income taxes are % rates; weights are based on distances and socio-economic similarities; panel data is used for 1990-2003.	GMM	

Table 4.18: Mandatory/Discretionary Functions of Cities/Towns and Counties*

Program	City and Town	County
Public Health		**M**
Juvenile Detention and Courts		**M**
Juvenile Probation		D
Youth Services	D	D
Hospital	D	D
Veteran's Programs	D	**M**
Cooperative Extension		D
Mental Health		**M**
Developmental Disabilities		**M**
Arts	D	D
Courts	**M**	**M**
Adult Detention Pre-trial	**M**	**M**
Adult Detention Felons		**M**
Public Safety (Crimes)	**M**	**M**
Traffic Enforcement	**M**	**M**
Public Defence	**M**	**M**
Attorney (City/County Cases)	**M**	**M**
Airport	D	D
Roads	**M**	**M**
Surface Water	**M**	**M**
Solid Waste Collection	D	
Solid Waste Disposal	D	D
Sewage Collection	D	D
Sewage Treatment	D	D
Planning (GMA)	**M**	**M**
Land Use Controls (GMA)	**M**	**M**
Boundary Review Boards		**M** (D in small
Parks and Recreation	D	D
County Fair		D
Building/Fire Code	**M**	**M**
Fire Suppression	D	
Historic Preservation	D	D

Table 4.18: CONTINUED

Program	City and Town	County
Community Development	D	D
Stadium	D	D
Water Supply	D	D
Electric Energy	D	
Licensing	D	**M**
Workmen's Compensation	**M**	**M**
Budget	**M**	**M**
Auditor		**M**
Elections		**M**
Administrative Support	D	D
Finance/Treasurer	**M**	**M**
Executive	**M**	**M**
Legislative Council	**M**	**M**
Assessor		**M**
Animal Control	D	D
Library	D	D
Involuntary Treatment		**M**
Emergency Medical Services	D	D
Medical Examiner		**M**
Air Pollution	**M**	**M**
Public Transportation	D	D
Employment and Training	D	D
Cemetery	D	

M = Mandatory; D = Discretionary; blank spaces = no authority or lack of significance

* See the MRSC website at www.mrsc.org/subjects/governace/functions.aspx.

Table 4.19: Total Expenditures of All Counties – All Funds, 2000 – 2005*

millions of dollars (and percentages of total expenditure)

All Revenues	2000	2001	2002	2003	2004	2005
Law & Justice Services	900.0 (22%)	971.0 (22%)	1,036.7 (22%)	1,066.0 (22%)	1,069.5 (21%)	1,133.6 (22%)
Fire & Emergency Services	110.9 (3%)	115.8 (3%)	127.3 (3%)	134.6 (3%)	152.7 (3%)	164.6 (3%)
Health & Human Services	440.4 (11%)	483.0 (11%)	493.3 (11%)	520.7 (11%)	707.8 (14%)	567.9 (11%)
Transportation	766.8 (18%)	765.3 (18%)	816.0 (18%)	826.8 (17%)	857.2 (17%)	902.0 (18%)
Natural Resources	282.1 (7%)	301.7 (7%)	304.4 (7%)	323.1 (7%)	320.9 (6%)	336.7 (7%)
General Government	275.2 (7%)	303.8 (7%)	300.6 (6%)	329.6 (7%)	317.6 (6%)	355.6 (7%)
Utilities	404.6 (10%)	431.0 (10%)	453.8 (10%)	455.7 (9%)	439.8 (9%)	490.3 (10%)
All Other	0.2 (0.005%)	0.1 (0.002%)	0.1 (0.002%)	0.1 (0.002%)	0.2 (0.004%)	0.2 (0.004%)
Capital	522.6 (12%)	572.5 (13%)	680.1 (15%)	697.4 (14%)	778.8 (15%)	607.2 (12%)
Debt Service-Interest	174.9 (4%)	182.9 (4%)	183.3 (4%)	175.8 (4%)	181.0 (4%)	188.8 (4%)
Debt Service-Principal	307.5 (7%)	231.6 (5%)	237.9 (5%)	303.4 (6%)	217.5 (4%)	296.4 (6%)
Grand Total	**4,185.2 (100%)**	**4,358.7 (100%)**	**4,633.5 (100%)**	**4,833.2 (100%)**	**5,043.0 (100%)**	**5,043.3 (100%)**

* The data source is the Local Government Financial Reporting System. Some expenditure categories may include only partial data.

Table 4.20: Total Expenditures of All Cities – All Funds, 2000 – 2005*

millions of dollars (and percentages of total expenditure)

All Revenues	2000	2001	2002	2003	2004	2005
Law & Justice Services	774.0 (13%)	822.2 (12%)	866.1 (12%)	883.5 (11%)	931.1 (12%)	959.2 (12%)
Fire & Emergency Services	432.3 (7%)	467.2 (7%)	477.7 (6%)	525.1 (6%)	557.9 (7%)	584.3 (7%)
Health & Human Services	51.6 (1%)	47.9 (1%)	53.0 (1%)	52.8 (1%)	52.0 (1%)	51.9 (1%)
Transportation	246.0 (4%)	266.3 (4%)	289.2 (4%)	300.7 (4%)	353.1 (4%)	345.7 (4%)
Natural Resources	629.5 (10%)	688.7 (10%)	725.6 (10%)	717.5 (9%)	740.9 (9%)	764.5 (9%)
General Government	241.0 (4%)	287.4 (4%)	306.1 (4%)	302.8 (4%)	337.2 (4%)	380.0 (5%)
Utilities	1,999.2 (33%)	2,317.1 (33%)	2,262.9 (31%)	2,526.9 (31%)	2,483.7 (31%)	2,547.0 (31%)
All Other	72.2 (1%)	75.8 (1%)	76.6 (1%)	79.0 (1%)	83.3 (1%)	84.0 (1%)
Capital	1,003.7 (17%)	1,223.5 (17%)	1,362.6 (18%)	1,431.0 (17%)	1,324.6 (17%)	1,444.9 (18%)
Debt Service-Interest	288.0 (5%)	313.1 (4%)	431.0 (6%)	321.5 (4%)	334.0 (4%)	343.2 (4%)
Debt Service-Principal	345.7 (6%)	486.4 (7%)	547.2 (7%)	1,079.6 (13%)	697.5 (9%)	640.2 (8%)
Grand Total	**6,083.2 (100%)**	**6,995.6 (100%)**	**7,398.0 (100%)**	**8,220.4 (100%)**	**7,895.3 (100%)**	**8,144.9 (100%)**

* The data source is the Local Government Financial Reporting System. Some expenditure categories may include only partial data.

Table 4.21: Municipalities Excluded due to Missing Data

Municipality	2005 Population
Black Diamond	4,080
Carbonado	645
Colton	400
Conconully	190
Dupont	5,410
Ellensburg	16,700
Elmer City	265
Hartline	135
Hatton	105
Index	155
Kahlotus	220
Krupp	60
Lamont	95
Latah	212
Lyman	450
Malden	210
Marcus	179
Nespelem	205
Reardan	610
Rock Island	875
Springdale	275
Starbuck	130
Stevenson	1,260
Toledo	685
Waverly	128
Wenatchee	29,320

Table 4.22: Adopted Property Tax Revenue Increases*

Total Collected Revenue (A)	Levies not Subject to 1% (B)	Levies Subject to 1% (C)	Actual Percentage Increase (D)
current regular levy / 1000 × existing property value	2004 regular levy / 1000 × [new construction value + growth in state assessed property] + assessed property value	(A) – (B)	([highest prior amount collected – (C)] / highest prior amount collected) × 100%

* since levies used in column (B) are not subject to 1% rule, 2004 regular levy is applied to them; calculation of an actual increase in column (D) is based on the fact that 1% is applied to the highest prior amount collected to determine the maximum allowable increase in the revenue from the existing property.

Table 4.23: Property Tax Level Regression, 2001

Explanatory variable	**Area based weights** (R^2=0.53)	**Density based weights** (R^2=0.52)	**Uniform weights** (R^2=0.52)
$SALEST_i$	-0.0404 (-1.029)	-0.0602 (-1.410)	-0.0495 (-1.215)
BOT_i	**-0.3714 (-2.300)**	**-0.4017 (-2.376)**	**-0.3955 (-2.293)**
$UTILT_i$	-0.1025 (-0.943)	-0.1300 (-1.177)	-0.1336 (-1.217)
$FEES_i$	-0.0339 (-1.487)	-0.0348 (-1.449)	-0.0343 (-1.418)
$INCOME_i$	**0.0014 (4.393)**	**0.0013 (4.158)**	**0.0015 (4.599)**
POP_i	0.0003 (1.516)	0.0003 (1.403)	0.0003 (1.280)
$AREA_i$	-0.5054 (-0.517)	-0.7990 (-0.791)	-0.5572 (-0.559)
$FEDAID_i$	**-0.0676 (-3.230)**	**-0.0686 (-3.169)**	**-0.0673 (-3.070)**
$STATEAID_i$	**-0.1179 (-5.676)**	**-0.1210 (-5.625)**	**-0.1208 (-5.566)**
$SPECEXPN_i$	**0.5944 (7.670)**	**0.6189 (7.580)**	**0.6055 (7.710)**
$REGEXPN_i$	**0.0635 (5.405)**	**0.0657 (5.230)**	**0.0657 (5.066)**
$NPROPT_i$	**0.2505 (1.961)**	**0.3561 (2.783)**	**0.2729 (2.459)**
$NSALEST_i$	-0.0648 (-0.794)	-0.0768 (-1.022)	-0.0845 (-1.226)
$NBOT_i$	-0.0335 (-0.204)	-0.2043 (-0.892)	-0.1751 (-0.695)
$NUTILT_i$	0.0640 (0.298)	0.1723 (0.908)	0.1917 (1.018)
$NFEES_i$	-0.0206 (-1.055)	-0.0149 (-0.652)	-0.0185 (-0.749)
Constant	**-43.9263 (-2.274)**	**-70.3305 (-2.853)**	**-62.7281 (-2.660)**

Table 4.24: B&O Tax Level Regression, 2001

Explanatory variable	**Area based weights** (R^2=0.25)	**Density based weights** (R^2=0.35)	**Uniform weights** (R^2=0.37)
$PROPT_i$	**-0.1041 (-2.697)**	**-0.1071 (-2.950)**	**-0.0996 (-2.790)**
$SALEST_i$	***-0.0317 (-1.795)***	-0.0170 (-0.954)	-0.0137 (-0.814)
$UTILT_i$	0.0324 (0.659)	0.0457 (0.991)	0.0553 (1.220)
$FEES_i$	-0.0042 (-0.406)	0.0063 (0.628)	0.0102 (1.018)
$INCOME_i$	***-0.0003 (-1.789)***	**-0.0003 (-2.195)**	**-0.0003 (-2.061)**
POP_i	**0.0004 (3.684)**	**0.0004 (3.947)**	**0.0004 (3.932)**
$AREA_i$	-0.1319 (-0.299)	-0.2443 (-0.581)	-0.1637 (-0.398)
$FEDAID_i$	-0.0040 (-0.407)	0.0020 (0.211)	0.0082 (0.882)
$STATEAID_i$	**-0.0208 (-2.013)**	-0.0128 (-1.282)	-0.0075 (-0.752)
$SPECEXPN_i$	**0.2076 (5.301)**	**0.1657 (4.225)**	**0.1597 (4.267)**
$REGEXPN_i$	0.0066 (1.123)	0.0012 (0.200)	-0.0032 (-0.549)
$NPROPT_i$	-0.0347 (-0.594)	0.0429 (0.783)	0.0626 (1.344)
$NSALEST_i$	**0.0857 (2.356)**	0.0218 (0.696)	-0.0106 (-0.371)
$NBOT_i$	**0.2001 (2.764)**	**0.3700 (4.031)**	**0.4878 (4.980)**
$NUTILT_i$	0.0383 (0.395)	0.0441 (0.557)	0.0384 (0.492)
$NFEES_i$	-0.0130 (-1.476)	***-0.0182 (-1.930)***	-0.0532 (-0.521)
Constant	-8.5225 (-0.961)	-3.9637 (-0.375)	-9.3766 (-0.941)

Table 4.25: Utility Tax Level Regression, 2001

Explanatory variable	**Area based weights** (R^2=0.40)	**Density based weights** (R^2=0.38)	**Uniform weights** (R^2=0.39)
$PROPT_i$	-0.0655 (-1.160)	-0.0839 (-1.444)	-0.0854 (-1.485)
$SALEST_i$	0.0137 (0.534)	-0.0104 (-0.369)	-0.0085 (-0.318)
BOT_i	0.0739 (0.691)	0.1106 (0.980)	0.1405 (1.224)
$FEES_i$	0.0199 (1.340)	0.0133 (0.842)	0.0108 (0.675)
$INCOME_i$	-0.0001 (-0.287)	-0.0001 (-0.284)	-0.00005 (-0.203)
POP_i	-0.0002 (-1.203)	-0.0001 (-0.958)	-0.0002 (-1.182)
$AREA_i$	**1.8243 (2.930)**	**1.5819 (2.423)**	**1.6556 (2.579)**
$FEDAID_i$	**-0.0306 (-2.190)**	**-0.0342 (-2.354)**	**-0.0371 (-2.536)**
$STATEAID_i$	**-0.0582 (-4.017)**	**-0.0634 (-4.204)**	**-0.0671 (-4.453)**
$SPECEXPN_i$	**0.1895 (3.207)**	**0.2351 (3.779)**	**0.2233 (3.717)**
$REGEXPN_i$	**0.0198 (2.376)**	**0.0243 (2.736)**	**0.0269 (2.956)**
$NPROPT_i$	-0.1074 (-1.280)	-0.0324 (-0.375)	-0.0037 (-0.050)
$NSALEST_i$	0.0543 (1.024)	0.0334 (0.677)	0.0246 (0.541)
$NBOT_i$	0.0526 (0.495)	-0.1878 (-1.253)	***-0.2804 (-1.708)***
$NUTILT_i$	0.0527 (0.377)	***0.2041 (1.650)***	0.1558 (1.263)
$NFEES_i$	-0.0055 (-0.433)	0.0013 (0.087)	-0.0011 (-0.068)
Constant	**32.8999 (2.614)**	9.6052 (0.577)	12.9575 (0.818)

Table 4.26: Per Capita User Fee Regression, 2001

Explanatory variable	**Area based weights** (R^2=0.61)	**Density based weights** (R^2=0.62)	**Uniform weights** (R^2=0.63)
$PROPT_i$	***-0.4884 (-1.671)***	-0.4732 (-1.624)	-0.4496 (-1.554)
$SALEST_i$	**-0.5055 (-3.969)**	**-0.6289 (-4.746)**	**-0.6070 (-4.813)**
BOT_i	-0.2163 (-0.389)	0.3222 (0.567)	0.5310 (0.917)
$UTILT_i$	0.4494 (1.224)	0.2807 (0.769)	0.2208 (0.606)
$INCOME_i$	-0.0010 (-0.885)	-0.0006 (-0.522)	-0.00003 (-0.028)
POP_i	***0.0014 (1.929)***	***0.0012 (1.650)***	0.0012 (1.626)
$AREA_i$	-3.6250 (-1.100)	-4.6509 (-1.404)	-4.6461 (-1.420)
$FEDAID_i$	**-0.4701 (-7.374)**	**-0.4847 (-7.664)**	**-0.4923 (-7.732)**
$STATEAID_i$	**-0.4688 (-6.758)**	**-0.4897 (-7.095)**	**-0.4984 (-7.227)**
$SPECEXPN_i$	***0.5990 (1.921)***	**0.7869 (2.471)**	**0.7071 (2.293)**
$REGEXPN_i$	**0.4191 (14.185)**	**0.4330 (14.485)**	**0.4433 (14.566)**
$NPROPT_i$	0.3327 (0.760)	0.4214 (0.973)	0.1252 (0.334)
$NSALEST_i$	0.2252 (0.816)	0.1461 (0.588)	0.1316 (0.576)
$NBOT_i$	**-1.3624 (-2.509)**	**-2.9991 (-4.176)**	**-3.5644 (-4.554)**
$NUTILT_i$	-0.7090 (-0.979)	0.0455 (0.073)	0.1483 (0.238)
$NFEES_i$	0.1070 (1.627)	**0.1758 (2.368)**	**0.1860 (2.314)**
Constant	65.5621 (0.988)	-68.7679 (-0.823)	-56.8049 (-0.712)

Table 4.27: B&O Tax Level Regression, TOBIT, Population Based Weights, 2001

Explanatory variable	Coefficient and its statistics
$PROPT_i$	-0.1046 (-0.680)
$SALEST_i$	***-0.1639 (-1.794)***
$UTILT_i$	**0.5640 (2.477)**
$FEES_i$	-0.0106 (-0.278)
$INCOME_i$	**-0.0014 (-2.144)**
POP_i	0.00007 (0.240)
$AREA_i$	1.7853 (1.114)
$FEDAID_i$	0.0135 (0.249)
$STATEAID_i$	-0.1587 (-1.358)
$SPECEXPN_i$	**0.3728 (2.843)**
$REGEXPN_i$	0.0053 (0.317)
$NPROPT_i$	0.0681 (0.334)
$NSALEST_i$	**0.3051 (2.433)**
$NBOT_i$	**0.6162 (2.118)**
$NUTILT_i$	-0.0207 (-0.054)
$NFEES_i$	-0.0028 (-0.088)
Constant	**-206.4255 (-3.376)**
Log likelihood	-266.0194

Comparing these with the second column of Table 4.11 in the chapter reveals a variety of similarities and differences. Most notable here are the larger coefficients on neighbours' sales taxes and neighbours' B&O taxes. Lower retail sales (reflected in lower sales tax revenues) across the border diminishes the opportunity for exporting a part of one's own B&O tax burden. As a consequence, the direct B&O tax interactions may present not only competition in tax rates among the bordering B&O tax cities, but also competition for tax exporting opportunities offered by their neighbours. The TOBIT model fails to assign any significance to the own property tax level, population size or per capita state grants – the determinants established by the 2SLS estimation – but recognizes a positive influence from the own per capita utility tax level. This may follow from the similarity between the B&O and utility tax bases, as they are charged on the gross income of businesses and public/private utility companies, respectively.

Table 4.28: Property Tax Level Regression, 2005

Explanatory variable	Area based weights (R^2=0.39)	Density based weights (R^2=0.39)	Uniform weights (R^2=0.37)
$SALEST_5$	**-0.1523 (-2.879)**	**-0.1750 (-3.088)**	**-0.1718 (-3.053)**
BOT_5	-0.2234 (-1.190)	-0.1462 (-0.721)	-0.1171 (-0.552)
$UTILT_5$	**-0.3914 (-2.869)**	**-0.3746 (-2.704)**	**-0.4021 (-2.834)**
$FEES_5$	**-0.1473 (-4.222)**	**-0.1510 (-4.003)**	**-0.1539 (-4.089)**
$INCOME_5$	0.0005 (1.262)	0.0002 (0.677)	0.0004 (0.992)
POP_5	0.0002 (0.782)	0.0001 (0.520)	0.0001 (0.400)
$AREA_5$	-0.5857 (-0.477)	-0.4747 (-0.381)	-0.2506 (-0.199)
$FEDAID_5$	**-0.1844 (-5.174)**	**-0.1873 (-4.998)**	**-0.1884 (-4.983)**
$STATEAID_5$	**-0.1840 (-6.084)**	**-0.1885 (-5.969)**	**-0.1869 (-5.930)**
$SPECEXPN_5$	**0.4971 (5.705)**	**0.4883 (5.636)**	**0.4991 (5.600)**
$REGEXPN_5$	**0.1515 (6.415)**	**0.1549 (6.046)**	**0.1558 (6.041)**
$NPROPT_5$	**0.3734 (3.599)**	**0.5175 (3.689)**	**0.3863 (3.217)**
$NSALEST_5$	-0.0014 (-0.018)	-0.0150 (-0.169)	0.0296 (0.341)
$NBOT_5$	-0.0150 (-0.076)	-0.2097 (-0.714)	-0.3405 (-0.987)
$NUTILT_5$	-0.1685 (-0.924)	-0.1305 (-0.679)	-0.0551 (-0.271)
$NFEES_5$	-0.0242 (-1.158)	-0.0271 (-1.072)	-0.0155 (-0.560)
Constant	10.6384 (0.388)	1.4477 (0.054)	-3.6654 (-0.137)

Table 4.29: B&O Tax Level Regression, 2005

Explanatory variable	Area based weights (R^2=0.38)	Density based weights (R^2=0.38)	Uniform weights (R^2=0.37)
$PROPT_5$	***-0.0687 (-1.927)***	-0.0403 (-1.114)	-0.0288 (-0.810)
$SALEST_5$	-0.0194 (-1.033)	0.0253 (1.261)	0.0233 (1.173)
$UTILT_5$	0.0632 (1.304)	**0.0989 (2.043)**	**0.1068 (2.163)**
$FEES_5$	0.0034 (0.260)	**0.0374 (2.749)**	**0.0385 (2.839)**
$INCOME_5$	**-0.0004 (-3.272)**	***-0.0002 (-1.753)***	**-0.0003 (-2.036)**
POP_5	**0.0003 (3.684)**	**0.0004 (4.323)**	**0.0004 (4.132)**
$AREA_5$	-0.3588 (-0.855)	-0.5171 (-1.228)	-0.4486 (-1.059)
$FEDAID_5$	-0.0057 (-0.409)	***0.0258 (1.805)***	**0.0289 (2.028)**
$STATEAID_5$	-0.0128 (-1.049)	0.0144 (1.139)	0.0162 (1.295)
$SPECEXPN_5$	**0.1247 (3.705)**	**0.1082 (3.239)**	**0.1074 (3.162)**
$REGEXPN_5$	0.0039 (0.399)	**-0.0232 (-2.276)**	**-0.0255 (-2.508)**
$NPROPT_5$	***0.0707 (1.881)***	-0.0576 (-1.131)	-0.0042 (-0.100)
$NSALEST_5$	0.0133 (0.493)	-0.0033 (-0.112)	-0.0334 (-1.165)
$NBOT_5$	**0.2718 (4.170)**	**0.6568 (7.384)**	**0.7876 (7.679)**
$NUTILT_5$	0.0160 (0.255)	-0.0056 (-0.085)	-0.0080 (-0.116)
$NFEES_5$	**-0.0199 (-2.811)**	**-0.0192 (-2.259)**	-0.0090 (-0.967)
Constant	-0.1049 (-0.011)	***15.0240 (1.672)***	5.8482 (0.648)

Table 4.30: Utility Tax Level Regression, 2005

Explanatory variable	**Area based weights** (R^2=0.07)	**Density based weights** (R^2=0.08)	**Uniform weights** (R^2=0.05)
$PROPT_5$	**-0.2128 (-3.357)**	**-0.2065 (-3.221)**	**-0.2047 (-3.232)**
$SALEST_5$	**-0.0925 (-2.747)**	**-0.0992 (-2.753)**	**-0.1052 (-2.945)**
BOT_5	0.1115 (0.940)	0.1965 (1.565)	***0.2196 (1.672)***
$FEES_5$	**-0.0598 (-2.566)**	**-0.0604 (-2.428)**	**-0.0681 (-2.733)**
$INCOME_5$	-0.0003 (-1.481)	-0.0003 (-1.369)	-0.0003 (-1.424)
POP_5	-0.0002 (-0.923)	-0.0002 (-1.137)	-0.0002 (-1.175)
$AREA_5$	***1.4782 (1.938)***	**1.5244 (1.993)**	**1.5611 (2.015)**
$FEDAID_5$	**-0.1001 (-4.193)**	**-0.1014 (-4.079)**	**-0.1058 (-4.249)**
$STATEAID_5$	**-0.1101 (-5.430)**	**-0.1095 (-5.178)**	**-0.1104 (-5.269)**
$SPECEXPN_5$	**0.1807 (2.930)**	**0.1823 (2.998)**	**0.1822 (2.920)**
$REGEXPN_5$	**0.0845 (5.216)**	**0.0850 (4.885)**	**0.0888 (5.126)**
$NPROPT_5$	***0.1223 (1.775)***	***0.1600 (1.724)***	***0.1415 (1.815)***
$NSALEST_5$	0.0413 (0.836)	-0.0115 (-0.213)	0.0147 (0.276)
$NBOT_5$	-0.1412 (-1.142)	***-0.3529 (-1.951)***	**-0.5214 (-2.462)**
$NUTILT_5$	-0.0249 (-0.216)	0.1465 (1.226)	0.1782 (1.410)
$NFEES_5$	0.0003 (0.025)	-0.0020 (-0.124)	0.0065 (0.374)
Constant	**34.3229 (2.021)**	22.8946 (1.386)	15.7580 (0.944)

Table 4.31: Per Capita User Fee Regression, 2005

Explanatory variable	**Area based weights** (R^2=0.41)	**Density based weights** (R^2=0.43)	**Uniform weights** (R^2=0.41)
$PROPT_5$	**-1.1187 (-3.125)**	**-1.0282 (-2.866)**	**-1.0193 (-2.881)**
$SALEST_5$	**-0.7910 (-4.605)**	**-0.8971 (-5.251)**	**-0.8771 (-5.122)**
BOT_5	0.0836 (0.119)	0.9264 (1.272)	1.0306 (1.358)
$UTILT_5$	-0.8399 (-1.626)	-0.7530 (-1.466)	***-0.8855 (-1.691)***
$INCOME_5$	**-0.0027 (-2.007)**	**-0.0030 (-2.346)**	**-0.0028 (-2.188)**
POP_5	0.0006 (0.567)	-0.00002 (-0.020)	-0.00002 (-0.023)
$AREA_5$	-0.3234 (-0.071)	0.4343 (0.096)	0.4965 (0.108)
$FEDAID_5$	**-0.8127 (-8.326)**	**-0.8158 (-8.506)**	**-0.8166 (-8.432)**
$STATEAID_5$	**-0.6455 (-6.635)**	**-0.6484 (-6.731)**	**-0.6341 (-6.531)**
$SPECEXPN_5$	0.1584 (0.421)	0.1299 (0.354)	0.1387 (0.369)
$REGEXPN_5$	**0.6637 (13.606)**	**0.6697 (13.720)**	**0.6704 (13.622)**
$NPROPT_5$	**0.9227 (2.357)**	**1.4172 (2.797)**	**0.9719 (2.224)**
$NSALEST_5$	***0.5418 (1.915)***	0.4908 (1.594)	**0.6259 (2.114)**
$NBOT_5$	**-1.5274 (-2.173)**	**-3.5778 (-3.841)**	**-4.1993 (-3.822)**
$NUTILT_5$	-0.9102 (-1.361)	-0.5378 (-0.771)	-0.2224 (-0.300)
$NFEES_5$	0.0522 (0.671)	0.0719 (0.781)	0.0851 (0.850)
Constant	78.1991 (0.770)	-11.2063 (-0.115)	-5.9557 (-0.061)

Table 4.32: Distribution of Total Property Tax Revenues by Category, All Funds*

PROPERTY TAX REVENUE TYPE	Dollar Amount, 2001	% of Property Tax Revenue, 2001	Dollar Amount, 2005	% of Property Tax Revenue, 2005	% Change between 2001 & 2005
Real & Personal Property Taxes-Restricted (special levies for M&O, debt funding or capital construction projects)	94,462,945	11.70%	122,372,813	12.29%	***29.55%*** **
Real & Personal Property Taxes-Unrestricted	711,531,171	88.14%	873,238,755	87.67%	22.73%
Diverted County Road Taxes (county levied and collected road taxes diverted to support city government)	1,254,198	0.16%	383,993	0.04%	-69.38%
Total Property Tax Revenue	**807,257,434**	**100%**	**996,074,258**	**100%**	**23.39%**

* The data source is the LGFRS. Some revenue categories may include only partial data.
** The percentage changes between 2001 and 2005 above the average (the percentage change of the total property tax revenues) are bolded and italicized

Table 4.33: BITE coefficients and significance in tax equations, 2SLS, Population Based Weights, 2005*

BITE Definition / Tax Equation	BITE= Dummy*× $PROPT_5$	BITE= Dummy× BOT_5	BITE= Dummy× $UTILT_5$	BITE= Dummy× $FEES_5$	BITE= Dummy× $SALEST_5$
$PROPT_5$	—	***0.5449*** ***(1.712)*** **	0.0715 (0.688)	-0.0153 (-0.926)	0.0758 (1.425)
BOT_5	-0.0264 (-1.293)	—	-0.0461 (-1.286)	-0.0032 (-0.552)	***-0.0355*** ***(-1.920)***
$UTILT_5$	0.0537 (1.474)	0.2899 (1.433)	—	-0.0137 (-1.339)	0.0468 (1.396)
$FEES_5$	**0.4835** **(2.326)** **	1.6495 (1.397)	0.3102 (0.801)	—	0.2875 (1.464)

* Dummy is defined as equal to one when the regular property tax revenue increase from 2004 to 2005 is 0.9% or higher and equal to zero otherwise. If only Dummy is used, it proves insignificant in all equations.
** Bolded coefficients are significant at 5%, bolded and italicized coefficients are significant at 10%.

Table 4.34: B&O Tax Level Regression, TOBIT, Population Based Weights, 2005

Explanatory variable	Coefficient and its statistics
PROPT5	-0.1445 (-1.023)
SALEST5	-0.1255 (-1.312)
UTILT5	**0.4944 (2.140)**
FEES5	-0.0130 (-0.353)
INCOME5	**-0.0013 (-2.318)**
POP5	0.0002 (0.693)
AREA5	0.9654 (0.586)
FEDAID5	-0.0306 (-0.371)
STATEAID5	-0.2124 (-1.343)
SPECEXPN5	**0.3114 (2.272)**
REGEXPN5	0.01208 (0.615)
NPROPT5	-0.0958 (-0.513)
NSALEST5	**0.3701 (2.709)**
NBOT5	**0.9511 (3.304)**
NUTILT5	0.2017 (0.588)
NFEES5	-0.0268 (-0.828)
Constant	**-204.5665 (-3.205)**
Log likelihood	-279.6445

A comparison of the TOBIT and the full 2SLS outcomes in 2005 (the second column of Table 4.14 in the chapter) proves informative as these results are observed to differ a bit more than in 2001. Of the four previously common determinants of B&O taxes in both models in 2001 (median income, special purpose expenditure, neighbours' sales and B&O tax levels), only the TOBIT estimates produce significant neighbours' sales taxes, whereas the 2SLS estimates do not. These new differences may be due to the first round of the model ordinance provisions aimed at a reduction in the B&O tax exporting practices which is expected to undermine the importance of the neighbours' sales tax levels but not completely eliminate it (until 2008).

Chapter 5. Conclusions

5.1. Research Objectives and Structure

This research was motivated by the financial situation of the Canadian municipalities, facing, on the expenditure side, increasing demands, especially for infrastructure upgrading, and, on the revenue side, a combination of slow-growing own property taxes and reduced grants. The difficulties of meeting increased demands for municipal programs and services with a limited tax base seem to have become more pronounced with the growing economic and competitive importance of cities and metropolitan areas in the provincial and national economies. The most recent wave of related publications recognizes the potential for the poor performance of under-funded municipalities to negatively impact the efficiency, growth and competitiveness of provincial and even national economies.

This study explores the idea of expanding municipal tax bases. This possibility is often suggested by Canadian public economists as the best way of providing municipalities with reliable financial resources while preserving their maximum operational flexibility. Consideration is restricted to the highly revenue productive sales and payroll taxes that are widely used by cities in the USA and Western Europe. The theoretical and empirical analysis proceeds to establish possible municipal responses to expanded tax choices and their determinants.

Initially, tax base diversification is examined in the context of an isolated municipality. The main purpose of the isolation condition is to begin with a relatively simple situation and to establish a benchmark. Next, a multi-jurisdictional setting is introduced where there is strategic inter-jurisdictional competition for perfectly mobile,

but scarce, private capital, defined as commercial property investment. The benefits from adding new taxes in the competitive environment are determined in the absence and then presence of limited residential mobility - cross border shopping for sales taxes and commuting for payroll taxes. Finally, the reaction functions derived from our model are estimated using two separate years of municipal data from Washington State. That estimation identifies the existence of strategic behaviour in major taxes, the influence of local characteristics and the impact of fiscal constraints.

5.2. Contributions and Results

Studies of municipal tax base diversification focus on the competitive environment, making literature on the isolated case virtually non-existent.[254] However, the adoption of a non-strategic setting prior to the introduction of tax competition contributes to a better understanding of tax choices and their implications. The isolated case can readily be extended to the complex multi-jurisdictional situation. This study begins by assuming a single property tax rate applied to both residential and non-residential property, no direct influence of the publicly provided good on private consumption, and homogeneous voter-taxpayers. It then moves on to consider separate tax rates on residential and non-residential property, and heterogeneous voters.

The theoretical analysis of tax base expansion in an isolated municipality leads to the following conclusions. First, once housing consumption is allowed to change in response to adjustments in the property tax rate, tax diversification becomes an attractive (utility enhancing) option under either non-benefit or benefit taxation. Second, additional tax revenue sources (such as a sales tax) allow a municipal government to increase the

[254] Pasha and Aisha Ghaus (1995) is the only known study outside of the competitive context. They look at the impact of the property and sales taxes on municipal size.

provision of services without discriminating against tax bases (e.g., rent extraction from business property).

The addition of strategic interactions to the theoretical model offers new insights into a municipality's tax choices. While this part of the research is linked to a number of the tax competition studies, it pursues a rather different model and analysis. The choice of assumptions and the methodological differences define its major theoretical contributions to the tax competition literature. The first major difference is that the underlying assumptions are intended to make the model more closely approximate Canadian municipal conditions. Mobile capital is restricted to commercial property investment, rather than all property investment,[255] and excludes immobile industrial capital and residential property. No production function is included in the model. Capital and labour are both assumed to earn a common regional (not internally determined) return. The municipal property tax rates are also differentiated for residential and commercial property. The residential property tax rates are assumed to be set to maximize the median voter's utility, whereas the commercial property tax rates are set to maximize the rents extracted from this property type. Usually the differentiation of property tax rates is only considered for land versus structures, rather than by property types,[256] and rent extraction is only explored outside of the voter utility maximizing setting.[257]

The analytical methodology is the second major source of differences. The two dominant approaches to examining tax choices in related studies – (a) consecutive

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[255] Zodrow and Mieszkowski (1986) and Brueckner and Saavedra (2001).

[256] Krelove (1993), Lee (2003) and Haughwout (2001) investigate uniform property taxation versus separate land and housing structure taxation. Haughwout (2001) takes non-uniform taxation to the extreme of land taxation only.

[257] To model rent extraction, Rauscher (1998) considers a tax revenue maximizing (or Leviathan) government and Noiset (2003) considers a government monopoly over a locally produced good.

consideration of single taxes (and alternative ways of levying them),[258] and (b) simultaneous consideration of multiple taxes in search of surviving candidates or necessary conditions for their existence[259] – do not allow for an adequate evaluation of the revenue enhancing performance of expanded tax bases. Therefore, we select a mixed comparison approach instead. That is, initially, a two-tax system is compared with a single tax system to determine if any improvement results. Next, property tax systems augmented with either sales or payroll taxes are compared with each other to determine their relative merits. Both exercises are repeated under cross border shopping and commuting, respectively, to see if the identified advantages can survive those conditions.[260] For the first time, all effects are analyzed separately for two types of municipalities – winners, whose tax bases are broadened by an inflow of foreign shoppers or commuters, and losers, whose tax bases are drained by an outflow of own shoppers or commuters. Such winner-loser consideration not only captures more strategic details behind municipal tax responses, but also explains the commonly observed fiscal phenomena of tax avoidance by some jurisdictions and tax rate clustering around a certain value.

The potential consequences of municipal tax base expansion in the strategic environment may be summarized as follows. First, a utility-maximizing local government favours property tax discrimination between property types as a politically inexpensive way to reduce pressure on, and to improve wellbeing of, its own citizen-voters. Second, the extent of competitive distortions depends not only on the degree of

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[258] Krelove (1993), Haughwout (2001), Lee (2003) and Pogodzinski and Sjoquist (1993).
[259] Braid (2000, 2005), Borck (2003) and Wilson (1995).
[260] While Braid (2000, 2002) incorporates commuting into his analysis of municipal tax choices under interjurisdictional competition, there are no known studies that include cross border shopping.

capital mobility and individual preferences, but also on the absence or presence of consumers' and workers' mobility. Third, a two tax system is concluded to remain generally superior to a single tax system since in most competitive cases municipal governments manage to reduce the perceived marginal costs of public service provision through tax diversification. Fourth, the sales tax is predicted to be a better option for tax diversification in the absence of cross-border shopping and commuting due to an additional negative effect imposed by the payroll tax on the MWTP of local residents. Fifth, on the other hand, the payroll tax is predicted to be a better option in the presence of cross-border shopping and commuting given less uncertainty in strategic outcomes and less intense rate-reducing tax competition. Sixth, the analysis reveals the potential to reconcile contradictory empirical findings.

The empirical application examines fiscal interactions among Washington State municipalities in a multiple tax multi-jurisdictional environment. The econometric model emerges from our theoretical model by employing the partially solved first order conditions.[261] While the significance of tax interdependence in own and neighbours' taxes is separately established by Heyndels and Vuchelen (1998) and Parys and Verbeke (2007), respectively, neither study provides sufficient arguments for inclusion of some fiscal variables and exclusion of others. Relevant fiscal variables in our empirical specification consist of all own and neighbours' taxes (effectively combining the approaches of Heyndels and Vuchelen (1998) and Parys and Verbeke (2007)), as well as current expenditure levels, a variable that is normally ignored. Another difference in the empirical specification is the addition of the user fee equation and of user fees as

[261] This technique is used by Brett and Pinkse (2000) to derive the empirical specification for one of their equations.

explanatory variables in the other tax equations. Despite their larger and growing importance in municipal finances (in Washington State they currently account for about 40% of the total municipal revenues), only Carlsen, Langset and Rattsø (2005) explore the implications of user fees. The diversity of Washington municipal own revenue sources prompts a revision, relative to most of the literature, of the units in which taxes are measured. Instead of conventional percentage tax rates, per capita revenues yielded by each tax and fee are used.[262]

Other differences with the literature are attributable to the particularities of the Washington municipal dataset. Current expenditures are divided into regular purpose expenditures, proxying services provided by all cities, and special purpose expenditures, proxying services provided by big cities independently and for small cities by special purpose districts. Low special purpose expenditures imply reduced municipal responsibilities and property taxing powers, a part of which have to be surrendered to the special purpose districts.

The model is estimated using 2SLS. The choice of 2SLS oyer 3SLS is motivated by the limited use of the business and occupation (B&O) tax (used by only 16% of all municipalities). The choice of 2SLS allows for further investigation of the B&O tax without affecting the results of the other regressions. The probabilities of cities adopting the B&O tax were examined using PROBIT analysis (including the Wooldridge two-step procedure to explore the possibility of sample selection bias).

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[262] Tax rates or effective tax rates are used by Heyndels and Vuchelen (1998), Brueckner and Saavedra (2001), Luna (2004), Brett and Pinkse (2000), among others. The exceptions are Ladd (1992), Parys and Verbeke (2007) and Carlsen, Langset and Rattsø (2005) who employ tax burdens, revenues per resident of a one percent tax and average user fees per standardized house respectively.

The empirical examination of municipal fiscal interactions in Washington State reveals the following findings. First, the municipalities interact in their property taxes both before and after property tax revenue growth was capped at 1%. Fewer than half the cities selected property tax revenue increases within the 0.75%-1.25% range under the new limit. Some generated larger increases, but the majority of the remaining jurisdictions chose smaller increases or actual decreases in their property tax revenues. Second, the business and occupation (B&O) tax appears to have been more responsive to neighbours' rates before a mandatory set of B&O taxation rules, known as the model ordinance, was introduced. Third, incentives for B&O tax adoption and determinants of existing B&O tax levels are found to diverge. This is in no small part due to the model ordinance provisions aimed at eliminating B&O tax exporting possibilities that appeared to motivate the adoption of B&O taxes. Fourth, there are no interjurisdictional interactions in utility taxes. This result is believed due to the fact that most cities adopted the maximum allowed rates on regulated utilities (mainly telephone and electricity) and were reluctant to increase the already high rates on unregulated utilities (garbage, water, sewer and drainage). Fifth, user fees do not display evidence of municipal interdependence. The analysis of changes in municipal finances indicates that user fees are increasingly employed to accommodate the impact of economic growth and numerous fiscal regulations. Sixth, the interdependence among own revenue sources is found to be stronger during an economic recovery and when restrictions on property and B&O taxes are tougher. Seventh, the responses to changes in neighbours' other (or non-matching types of) taxes are rather limited and do not experience much of a change.

5.3. Policy Implications

The analysis here suggests that Canadian municipalities could benefit from access to additional tax sources in a number of ways. A major advantage is the efficiency gain from a lower marginal cost of municipal revenues due to tax diversification distributing the local tax burden over a range of economic activities. A second advantage is that it may also reduce the discrimination between property types, lowering the non-residential property tax rate (and extracted rents) and, thus, bringing down the cost of doing business in Canadian cities.[263] To draw more specific conclusions, we need to calculate the net gain from adding new taxes to the municipal governments' finances. This would involve calculating the "gain" from "improvement" in recourse allocation and the administration and compliance costs of levying these taxes at the local level. Also any net gain from expanding the local governments' tax bases would have to be compared against the alternative increases in the provincial and/or federal grants to the municipalities. However, it should be noted that higher provincial and/or federal grants to local authorities raise immediate concerns about diminished municipal accountability to taxpayers-voters and likely misperception by them of the cost of local public goods.

Fiscal interactions among municipalities and a competitive environment are the reality of most cities and especially those in metropolitan areas. In that type of fiscal environment, the benefits of tax base diversification are expected to be moderated. By choosing to shop or to work outside of their place of residence, taxpayers create waves of fiscal distortions throughout local economies. Tax diversification broadens these

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[263] As demonstrated in Chapter 3, the derivatives of the business property tax rate with respect to the sales and payroll tax rates are always negative. In other words, a reduction in the private good consumption following the introduction of and any increases in sales or payroll taxes has to be accompanied by lower business property taxes to prevent additional business capital flight.

opportunities. For this reason, efficiency benefits may be very unevenly spread across the jurisdictions, as is the case of local sales taxation under cross border shopping. With certain consumption preferences, the sales tax base erosion due to cross border shopping activities can get so extreme that a tax burden importing municipality may choose not to adopt a sales tax. If the sales tax base erosion is less severe, an affected municipality may try to match the rate of a tax burden exporting neighbour, causing both rates to cluster around the same value. In both these cases, sales tax revenue losses from shopper outflow constrain sales tax rate setting.

Two municipal characteristics can diminish the potentially adverse impact of cross border shopping. First, greater distances between major urban centres reduce the adverse impacts of cross-border shopping and commuting, making sales and payroll taxation less of a challenge.[264] But, especially in metropolitan areas, many municipalities are clustered together. However, and second, if the majority of the municipalities are relatively small in size and dominated by one large city, the impacts of cross-border and commuting are reduced. Small municipalities in the agglomeration are likely to adopt low sales tax rates to take advantage of an inflow of shoppers, but the differences in municipal size ensure that small city actions will hardly affect the sales tax bases of the large city, prompting little or no response from it.

The empirical chapter provides insight into the determinants of municipal fiscal choices. Though the analysis is specific to Washington State, some general implications can be drawn from it. First, the effects of tax rate and revenue growth limits vary, depending on how tightly those limits are defined and how closely they are followed and

[264] The possible introduction of a local sales tax in Great Britain was examined in the British Government's 'Green Paper: Alternatives to Domestic Rates' (1981) and rejected in 1981 due to likely strong impacts of cross-border shopping on the closely located British municipalities.

enforced. Therefore, these restrictions are not suited to adjusting the strength of competitive municipal responses (that is, to reduce municipal tax competition). Second, when access to additional and constrained taxes is available, limits on the growth of property tax revenues can effectively prevent over-utilization of property taxes by promoting greater interdependence between own tax revenue sources. Third, regulations aimed at reducing or eliminating tax exporting opportunities appear to negatively affect municipal strategic behaviour by making tax competition more difficult. Nevertheless, there is no need for municipal tax diversification in Canada to be accompanied by tax rate and revenue growth restrictions for two major reasons. First, with the availability of additional taxes, municipalities will be inclined to utilize them, especially if provincial policies encourage parallel moves by others. Property taxes tend to be reduced in response. Second, local taxpayer-voters (through their preferences) and not the province (through its restrictions) should determine municipal tax and public output choices.

5.4. Model Limitations and Future Research

To undertake an in-depth analysis of municipal tax choices, this study employs a number of restrictive assumptions. First, senior government taxation (as well as service provision) is excluded from the theoretical and empirical framework. Their tax rates and any related vertical externalities may affect the overall social marginal cost of revenues and could impact the selection of tax instruments for local tax base diversification. Although an oversimplification, this local perspective allowed us to model more complex municipal tax relationships with horizontal externalities, such as cross border shopping or commuting. In the empirical application, we initially did control for a county effect by using a dummy variable that took on the value of one if a city and all its neighbours are in

the same county and zero otherwise, but, because it was insignificant in all four tax equations, those results were not reported.

Second, no municipal borrowing is incorporated in the theoretical model. In Canada and the U.S., as in many other countries, municipal borrowing is essentially restricted to that level necessary to finance capital expenditure and is largely used to smooth revenue requirements when faced with lumpy capital outlays. [265] Thus, borrowing and capital programs are more an interim financing matter than a determinant of the choice of taxes. However, debt servicing costs are a demand for revenues and a constraint on program expenditures. Hence, debt payments are incorporated in the empirical model of Washington municipalities' finances.[266]

Third, the theoretical analysis does not include senior government grants, although they are invoked to derive the appropriate empirical specification. Grants are usually an important source of municipal revenue and affect expenditure and tax decisions, but, unless specially aimed at impacting intermunicipal spillovers (as some will) – migration of labour or capital, cross-border shopping, commuting – will not affect our model. Results of our model, however, could have implications for grant design that could be explored.

More opportunities for theoretical research are offered by variations in some of the original assumptions. One of the possibilities is to restrict mobility of commercial (retail) property investment so that it is less than perfect. This change is expected to result in a mitigation of municipal tax competition and an increase in the amount of extractable rents in each jurisdiction. A second possibility is to allow some degree of resident

[265] See Bird and Tassonyi (2001) for a discussion of municipal borrowing restrictions in Canada.
[266] They are commonly misclassified in the Local Government Financial Reporting System of Washington State, making it difficult to separate them from actual ongoing/operating/current outlay.

mobility to correct the imperfections of initial sorting. People's ability to relocate is likely to have the opposite equilibrium effect, leading to stronger local competition in residential taxes. Third, the inclusion of industrial property investment becomes relevant after the assumption of its complete immobility is relaxed. Its impact on municipal tax choices would depend on the assumed functions of industrial capital and the local taxes levied upon it, but it has a potential to enhance (at least, to some extent) local tax interactions. The theoretical model may also benefit from the replacement of local payroll taxes with local personal income taxes which are common in the USA.[267] The appeal of income taxes to municipalities may be attributed to inexpensive piggybacking onto state personal income tax bases and greater revenue raising capacity.

On the empirical front, more work can be done on extensions of the model and the estimation methodology. First, based on the above-discussed changes in the original theoretical assumptions, new reaction functions can be derived and estimated to re-evaluate the responsiveness of municipal tax bases and its determinants. Second, the lack of variations in municipal sales tax rates in Washington State minimized the issue of cross-border shopping, whose implications, for municipal tax choices have yet to be explored. Third, this study detected differences in the tax interactions of Washington cities in recessionary and non-recessionary years. The extent to which municipal fiscal responses are actually impacted by existing economic conditions can be further investigated using more years of municipal data. Finally, there is a possibility of unaccounted for effects that may be captured through the application of spatial

[267] See Sjoquist, Wallace and Edwards (2002, p.39)

econometrics (although Brueckner (2003) considers the IV approach to be consistent in the presence of spatial error dependence).[268]

There is even greater potential for future empirical research on the subject in general. First of all, local payroll taxes require more attention. A similar study should be done for U.S. municipalities that use payroll taxes as well as other taxes and user fees.[269] Such work could be extended to analyze behaviour when local personal income taxes are used. Restrictions on property taxes have been common in the United States and subject to investigation. However, Washington State offers a new opportunity to observe municipal fiscal adjustments induced by a change in these restrictions. The 1% cap on the growth of the regular property levy was overturned in the State Supreme Court at the end of 2007, so the previous cap of the lesser of the inflation rate or 6% became effective instead.

This dissertation has provided insight into why municipal governments may prefer to diversify their tax bases and to the nature of fiscal choices and interactions in a multi-tax and multi-jurisdictional environment. Despite these advances, we are still some way from the information necessary to predict the consequences of expanding the types of taxes available to local governments in Canada. Towards that end, more research is necessary.

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[268] See Brueckner (2003, p.184-185).

[269] Potential candidates include California, New Jersey and Oregon. In Oregon local payroll taxes remain a rather insignificant source of municipal revenues.

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